

TECHNOLOGICAL UNIVERSITY (MYITKYINA)
DEPARTMENT OF CIVIL ENGINEERING

CONFIDENCE INDEX OF CIVIL ENGINEERING
STUDENTS ON CRUCIAL
ATTRIBUTES FOR ENGINEERING WORKPLACE

BY

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SEPTEMBER, 2019
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DEPARTMENT OF CIVIL ENGINEERING

We certify that we have examined, and recommend to the University Steering Committee for under Graduate Studies for acceptance of the mini thesis entitled **"CONFIDENCE INDEX OF CIVIL ENGINEERING STUDENTS ON CRUCIAL ATTRIBUTES FOR CIVIL ENGINEERING WORKPLACE"** submitted by **MA JA MAI RA, Roll No. VIC-11, MG PETER, Roll No. VIC-19, MG HLAING MIN SWE, Roll No. VIC-58, MA PYAE PYAE PHYO, Roll No. VIC-72, MG DANIEL HTIN SENG, Roll No. VIC-75 (December, 2018)** in partial fulfillment of the requirements for the degree of Bachelor of Engineering (Civil).

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ABSTRACT

Technological Universities are the major provider of engineering for human resources in Myanmar. This study attempts to examine the confidence level of First Year to Sixth Year Civil Engineering students from Technological University (Myitkyina) on seven generic attributes that are crucial in the dynamic and challenging world of Civil Engineering workplace in the 21st Century. The students' confidence index are gained by using the seven generic skills. Questionnaire sets were distributed to Civil Engineering students and they had to rank their confidence index level themselves from (0 to 10). The results highlight the strengths and weaknesses of the current students. Students show lowest confidence in business skills and highest confidence in their own attitudes. In this way, they can recognize which skills have to be elevated and can become professional engineers in upcoming.

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CHAPTER 1

INTRODUCTION

1.1. General

Technological Universities are the major providers of engineering for human resources in Myanmar. There are twenty-eight Technological Universities in Myanmar. Technological University (Myitkyina) is located in Myitkyina Township, Kachin State. There are four major specializations that are Civil Engineering, Electronics Engineering, Electrical Power Engineering and Mechanical Power Engineering in Technological University (Myitkyina).

Among these specializations, Civil Engineering is a professional engineering discipline that deals with the design, construction, and maintenance of the physical and naturally built environment, including works such as roads, bridges, canals, dams, airports, sewerage systems, pipelines, and railways. Civil engineers create, develop and protect the environment by planning, designing and overseeing construction and maintenance of building structures and infrastructure, such as roads, railways, airports, bridges, harbors, dams, irrigation projects, power plants, and water and sewerage systems.

This study attempts to demonstrate the attributes that are crucial for Civil Engineering students to become competent human resources in the dynamic and challenging world of civil engineering workplace in the 21st Century.

Several Civil Engineering students from Technological University (Myitkyina) participate in this study. A survey questionnaires consisting of seven generic skills and attributes, and several sub-groups (specialist skills) within each generic group, as proposed by Pudlowski and Darvall, from which respondents could make a selection, which are developed to assess the self-assurance degree of the students.

1.2. Aims and Objectives of the Study

The aim of the study is to demonstrate the attributes that are crucial for engineering students to become competent human resources in the engineering workplace. The objectives of the study are:

1. To examine the most essential attributes required for the Civil Engineering education.
2. To evaluate the self-assurance degree of First Year to Sixth Year Civil Engineering students from Technological University (Myitkyina).

1.3. Scopes of the Study

The scopes of the study are:

1. Questionnaire sets are distributed to current Civil Engineering students from Technological University (Myitkyina)
2. Analyzing the survey data is done by evaluating central tendencies in Microsoft Excel.

1.4. Outlines of the Study

This study is classified into five chapters. Chapter 1 presents introduction, Chapter 2 involves literature review, Chapter 3 includes methodology, Chapter 4 consists of data analysis and results, and Chapter 5 is conclusion and recommendation.

CHAPTER 2

LITERATURE REVIEW

2.1. General

This chapter covers the concept of engineering, the concept of civil engineering, the changes in civil engineering education, and the general attributes that are crucial to survive in the dynamic world of Civil Engineering workplace in addition to a brief history of Technological University (Myitkyina).

2.2. The Concept of Engineering

“Engineering is a profession directed towards the application and advancement of skills based upon a body of distinctive knowledge in mathematics, science and technology, integrated with business and management and acquired through education and professional formation in an engineering discipline. Engineering is directed to developing and providing infrastructures, goods and services for industry and the community”.

“An engineer is a person who possesses knowledge of mathematics and natural sciences and through the principles of analysis and design applied this knowledge to the solution of problems and the development of devices, processes, structures, and systems”.

2.3. The Concept of Civil Engineering and the Role of Civil Engineers

Civil engineering is one of the oldest engineering disciplines because it deals with constructed environment, including planning, designing, and overseeing construction and maintenance of building structures, and facilities, such as roads, railroads, airports, bridges, harbors, channels, dams, irrigation projects, pipelines, power plants, and water and sewage systems.

A civil engineer is a person who practices civil engineering – the application of planning, designing, constructing, maintaining, and operating infrastructures while protecting the public and the environmental health, as well as improving existing infrastructures that have been neglected.

2.4. The General Skills and Attributes Required for the Civil Engineering

Workplace

Engineering can be described as a broad field that embraces knowledge and training in humanities and social sciences, business and management, computer and technology, and, mathematics and science. In order for engineers to function effectively in such a multidisciplinary environment, engineering education must have the capacity to instill its graduates with skills and attributes from these diverse areas.

2.4.1. Humanities and Social Sciences

Among the three visions for the engineering profession identified by The National Academy of Engineering Report, one of which states “We aspire to engineers who will remain well-grounded in the basics of mathematics and science and who will expand their vision of design through solid grounding in humanities, social sciences and economics.”

In the ‘Humanities and Social Sciences with the Aspect of Engineers’ course, it is recognized that the careers of the future civil engineer need to be underpinned by education in the humanities and social sciences as well as mathematics and natural sciences. While Civil Engineering is a technical discipline, the strong technical education must be continued, two new program outcomes, one each in humanities and social sciences have been included. The inclusion of these two outcomes in the curriculum makes explicit that the contributions of Civil Engineers are largely to and for human society. Humanities include subjects such as art, ethic, philosophy and literature while social sciences include subjects such as political science, economics, sociology and psychology.

2.4.1.1. Social Skill

Social skills are the skills used to communicate and interact with each other, both verbally and non-verbally, through gestures, body language and personal appearance. Human beings are sociable creatures and they have developed many ways to communicate the messages, thoughts and feeling with others. Developing social skills is about the awareness of how humans communicate with each other, the messages they send and how methods of communication can be improved to make the way they communicate more efficient and effective.

Developed social skills can bring more and better relationships with various parties and can help to achieve more job satisfaction and opportunities. Important

social skills involve cooperation, listening, being patient, participation, accepting differences, positive communication and interaction, welcoming, sharing, helping others and following directions.

2.4.1.2. Presentation Skill

A presentation is the process of presenting a topic to an audience. It is typically a demonstration, introduction, lecture, or speech meant to inform, persuade, inspire, motivate, or to build good will or to present a new idea or product. Whether communicating with technical or non-technical audiences, engineers have to speak confidently and engage with people in team meetings, workshops, client briefs and seminars.

Oral presentation skill functions as an effective tool to assist engineering graduates to perform workplace jobs effectively and thereby excel in job promotion ladder too fast. However, students are found to have low self-confidence, stress and nervousness and low motivation that hindered effective oral presentation.

2.4.1.3. Interpersonal Skill

Good interpersonal skills are essential to a successful engineering career. The work of an engineer is not just technical; engineers frequently liaise with customers and work in multidisciplinary teams so that strong interpersonal skills are essential. They're important because such a skill set may help them set apart from other candidates with similar technical expertise when they apply for job vacancies.

Being a Civil Engineer, the size of one's network is proportional to his/her interpersonal skills. If one's aim is the top rung of the career ladder, it is a must to understand how to interact properly with different stakeholders, besides from being good technically.

2.4.2. Business and Management

The students should have the business and management skills. They are mentioned in the following topics.

2.4.2.1. Leadership Skill

In every industry, strong, efficient leadership is necessary to run businesses smoothly. Engineering is no exception. Leadership is more than simply managing a

team or making a schedule. Leadership encompasses a number of qualities and abilities, and engineering leadership is a skill an engineer can benefit from at any level. Good leaders can inspire their teams through instruction and support, enabling everyone to do their best work.

2.4.2.2. Business Management Skill

The fundamentals of business management in engineering field include understanding of the business processes that engineering graduates will encounter, either directly or indirectly, in their careers. It covers corporate financial reporting, business plans, development processes, project management, supply chains, globalization, outsourcing, emotional intelligence, effective presentations, management processes, and quality concepts.

Students who complete a comprehensive engineering-business program will have a distinct advantage in the job market. Their business skills will give them a fast start in industry. For example, they will be able to read a company annual report and analyze its financial health and sources of cash and have increased confidence when interacting with executives. They will also have a working knowledge of contemporary techniques in product development, supply chain and quality, outsourcing, and e-business.

2.4.2.3. Team-working Skill

Engineering teams function in such manner that the effectiveness of the team dictates the timeliness and the accuracy of the process and the success of the project. It is rare that an individual can remain isolated in the office and still excel in the job. Most engineering organizations are looking for individuals with a particular, tactical, skill set: the ability to work well in a team and to influence and motivate people to get things done.

Engineers tend to be more factual in the team interactions. That is, most engineers are direct and up-front, not necessarily earning diplomatic awards yet conveying factual information with limited regard for individual sensitivities. Some engineers have no qualms about pointing out an incorrect calculation, their own or others', or critically questioning an approach, implementation, or procedure. Typically, most of the time, these encounters are not personal. Rather, their aim is to arrive at the correct or feasible engineering solution.

2.4.2.4. Accounting Skill

Accounting is the systematic and comprehensive recording of financial transactions pertaining to a business. Accounting also refers to the process of summarizing, analyzing and reporting these transactions to oversight agencies, regulators and tax collection entities.

Over the years, engineers have become a niche area within the accounting and finance firm. A broad range of engineers including Civil, Chemical and Computer Engineers have to deal with finance and accounting. It's a challenging profession and engineers need to be big picture thinkers to scope projects like the construction of roads, bridges, pipelines, power plants, canals, dams and buildings. It is therefore no surprise to find that many engineers struggle with their business administration and bookkeeping. In fact, some of the engineering personnel have told that they wished their tertiary education included an 'engineering economics' module to help them understand the financial aspects of running their own engineering business.

2.4.3. Computer and Technology

Computer and Technology play a vital role in our daily lives. There is no place in the world where they are not used. They include the following skills to become skillful the candidates.

2.4.3.1. Computer Skill

In the past, engineers would draw up a design by hand and then give it to a draftsman to draw it up on the computer. Nowadays, engineers do everything from conceptual to final design on the computer themselves. Some of the tasks they might do on AutoCAD (especially for Civil Engineers) include grading of land, cut and fill calculations, road profiles, site plans, etc. Being proficient in computer skills is especially important in today's economy. When looking for a job, most prospective employers will certainly ask about one's CAD skills during the job interview.

Depending on one's engineering discipline, it should be researched what other specific programs are needed to know and learn as soon as possible. Some examples of Civil Engineering software consist of Microsoft Project, Primavera, ETABS, Tekla Structures, ArcGIS and Photoshop.

2.4.3.2. Programming Skill

To be an excellent civil engineer, it is definitely necessary to learn some programming skills. Whether in design field or construction field, engineers need some heavy calculations to do from time to time and specific software will not cater for everything they need. That is when the programming skills come to play, whether it is API language under specific software like .NET in all Autodesk software, or doing scientific calculation or stimulation using Matlab or Python.

2.4.3.3. Technical Skill

The Civil Engineers also require hard skills, particularly technical skills, advanced skills in mathematics, including algebra, geometry, trigonometry, calculus and statistics are crucial to a Civil Engineer, who must apply the appropriate mathematical formulas and principles in his design work as well as in problem solving. As project budgets and costs are an integral part of his responsibilities, he must also be proficient in reading and interpreting financial spreadsheets. An engineer must be highly skilled in physics and the practical application of scientific rules, methods and the technology involved in many aspects of the project, including design principles, construction methods and materials, soil analysis, and numerous environmental factors. It is also important for a Civil Engineer to be skilful in architectural design techniques and working with blueprints, maps, drawings and models, as well as computer programmes used in architectural design and construction. They must be skilled in Mathematics and Physics, as well as map reading, design techniques, and Computer-Aided Design (CAD) software.

2.4.3.4. Design Skill

Civil designers can use computer-aided design (CAD) programs to draft, scale, and fine-tune drawings and maps for roads, bridges, and other construction projects. They also assist project managers and engineers in determining material, labor, and other costs. Civil designers may work on a variety of specialized projects, such as wastewater control, water supplies, erosion control systems, underground utilities, or traffic management. Civil design jobs can require a combination of office and occasional field work, depending on the project.

2.4.4. Mathematics and Science

Mathematics and Science include (i) problem solving skill, (ii) research and development skill and (iii) analysis and synthesis skill.

2.4.4.1. Problem Solving Skill

Analytical skills are absolutely vital. During the different stages of a project, such as planning and construction, engineers will encounter a number of variables that will influence the outcome or hold up the progress of a project. This is when engineers need to harness their skills, education, and experience in order to find safe and cost-effective solutions to the issues that arise while keeping the project on track.

Engineering is rife with situations that requires diligent problem-solving. Engineers must be able to approach every task and problem with a cool, unemotional, analytical mind. They need to solve all aspects of a problem while taking minimum risks. Problem-solving is an engineering process in which where each solution is tested and modified. It is often necessary to test several solutions before deciding which is best.

2.4.4.2. Research and Development Skill

Constriction field adopts theories and principles which are a century old, so is the use of cement. There is little change that happened in the construction practices over the past few decades. The following facts are a few areas where a lot of R&D requirements:

1. reduction of the use of water for concreting and its curing,
2. recycling of building rubble and waste,
3. substitute for cheaper aggregates without compromise on strength,
4. ways and means of reducing construction costs,
5. building management systems,
6. building automation systems,
7. affordable retrofitting and repairing of building elements,
8. new building materials using wastes and byproducts,
9. high strength concretes which can be produced economically resulting in lesser usage of reinforced steel,
10. more IT into constriction industry,
11. more construction mechanization and automation resulting in lesser labor force and

12. plastics into structural engineering.

2.4.4.3. Analysis and Synthesis Skill

Analysis refers to given a structure, finds its behavior and other properties; an entity (a whole) is decomposed and explored, using causality as a premises, and mathematical models e.g. the engineering sciences. Synthesis means given the desired behavior and other requirements, find a structure that satisfies the behavior and requirements – usually one of several possible structures; explore, select and unite the (often opposing or contradictory) units, and moderate and overcome any contradictions, using finality as the aim, including creativity, to find and select among candidate solutions for a TP(s) and/or TS(s) – design engineering.

2.5. Brief History of Technological University (Myitkyina)

A technological university is a type of university which specializes in engineering, technology, applied science, and sometimes natural sciences. There are twenty-eight Technological Universities in Myanmar. Technological University (Myitkyina), where this study was conducted and it is located in the South-West of Myitkyina Township, Kachin State.

It was established in 1981 as Government Technological High School (G.T.H.S). Later, it was promoted into Government Technological Institute (G.T.I) in 1997. Two years later, it was upgraded into Government Technological College (G.T.C). Afterwards, it was promoted to the Technological University (Myitkyina) in 2007. There are four major departments in Technological University (Myitkyina). They are;

1. Civil Engineering Department
2. Electronics Engineering Department
3. Electrical Power Engineering Department and
4. Mechanical Power Engineering Department.

CHAPTER 3

METHODOLOGY

3.1. General

This study attempts to demonstrate the attributes that are crucial for civil engineering students to become competent human resources in the dynamic and challenging world of civil engineering workplace in the 21st Century. Several civil engineering students from Technological University (Myitkyina) participated in this study. A survey questionnaires consist of seven generic skills and attributes, and several sub-groups (specialist skills) within each generic group, as proposed by Pudlowski and Darvall, from which respondents could make a selection, was developed to assess the self-assurance degree of students.

3.2. Research Design

This research consists of five stages. The first stage of the research covers literature review. Literatures of the essential skills and attributes of an engineer and engineering education are revised. The second stage contains questionnaire design for launching to various stakeholders. In this study, these stakeholders include Civil Engineering students from Technological University (Myitkyina). The third stage is surveying by questionnaires and interview. The questionnaires are distributed to the First, Second, Third, Fourth, Fifth and Sixth Year Civil Engineering students in Technological University (Myitkyina) and interview is conducted. The fourth stage of this study consists of data collection form the respondents and data analysis. Firstly, collected data are analyzed by calculating the central tendency. And the last stage contains discussion, conclusion and recommendation. Research sequence is presented simply by the flowchart indicated in the figures in the next chapter.

3.3. Description of Questionnaire

There are seven generic skills and attributes listed in the survey.

1. Technical Knowledge and Skills: Essential sufficient technical skill to accomplish the mechanics of a particular job for which is responsible (these skills would presumably be part of an undergraduate degree

curriculum) for practical ability e.g., use of modern technology.

2. Intellectual Skills: ability to learn and understand new information and the methods an individual can use to evaluate or organize information and data.
3. Attitudes: behavior, thoughts and actions.
4. Standards of Engineering Practice: awareness and observance of engineering codes of practice and ethics; understanding of the role of an engineer; and general knowledge of the working legislation and regulations.
5. Business Practices: understanding of economic and financial issues, and ability to work within a business-orientated environment.
6. International/National History and Culture: understanding of other cultures and customs.
7. Proficiency in Languages: understanding other languages and familiarity with technical language.

The following are a list of the specialized skills and attributes which are ranked by the groups. These qualities are included in the survey to assist in defining precisely what skills and attributes an engineer is expected to possess.

3.3.1. Technical Knowledge and Skills

Technical knowledge and skills encompasses the following specialist skills and attributes.

1. Science fundamentals: knowledge of the basic laws, concepts, theories and principles of science, and understanding of other scientific fields e.g., chemistry, biology, computer science, earth science, environmental science etc.
2. Engineering fundamentals and application: knowledge of the basic laws, concepts, theories and principles of engineering.
3. Probability and statistics: the ability to apply mathematical equations and formulas to solve engineering problems and to do statistical analysis.
4. Computer science and technology: knowledge and ability to use current software and technology.
5. Engineering practice: engineering application, hands-on-skills and hands-on-approach; invention and development of a product; application of

technological tools.

3.3.2. Intellectual Skills

Intellectual skills are defined to include the following points.

1. Logical thinking: the ability of an individual to think in a disciplined manner or base his thoughts on facts and evidence and incorporating logic into one's thinking process whenever analyzing a problem on order to come up with a solution.
2. Problem-solving skills: the ability to resolve issues, problems and tasks.
3. Communication skills: the ability to exchange information with other people in the organization and community. To be able to send and receive information, thoughts and feelings, which create common understanding and meaning.
4. Design skills: the ability to sketch, plan and work out designs creatively.
5. Organizational, management and administrative skills: the ability to organize effectively; the ability to coordinate, supervise and manage.
6. Research: Liberal Arts teaches that it is critical to postpone spouting an opinion before the subject matter is thought than just his/her own anecdotal experience. It is easy to get opinionated but it needs data and evidence from experts such as those found in refereed journals to round off his/her own learning. Class research papers force him/her to think broadly rather than narrowly.

3.3.3. Attitudes

Attitudes can be defined in the survey to include.

1. Competence: the ability to carry out a task and to do the work.
2. Integrity: trust and loyalty to the organization and colleagues.
3. Commitment: dedication to the organization.
4. Tolerance: the ability to withstand and endure pressures and conflict arising in the workplace.
5. Flexibility: the ability to adjust to change. Ability to deal with ambiguous and complex situations and rapidly changing demands.
6. Commitment to lifelong learning: conditioned to pursue further education.
7. Reliability: Can the person be relied on? Is the person dependable?

8. Conscientiousness: Is the person attentive and disciplined in their work?
9. Punctuality: the ability to be on time and to meet schedules.
10. Approachability: Can the person be easily approached? Is the person friendly?

3.3.4. Standards of Engineering Practice

Standards of engineering practice are defined to embrace the followings.

1. Measurement systems: understanding of standard international measurement systems.
2. Technical standards: familiarity with the regulation, codes of practice and standards imposed on technical procedures.
3. Specifications and inspection standards: familiarity with technical specifications and standards.
4. Testing practices: understanding of common testing procedures in engineering.
5. Environmental constraints: awareness of environmental standards and regulations that must be addressed in engineering application and practice.
6. Code of ethics: obedience to the standards and codes set by professional bodies; awareness of professional and ethical responsibility to the community.
7. Proficiency standards: knowledge of engineering codes/ regulations/ guidelines.

3.3.5. Business Practices

Business practices consist of the following specialized skills and attributes.

1. Free market economy: knowledge of the concepts, principles and operation of the free market economy.
2. International marketplace: understanding the global economy as it relates to national markets.
3. Multinational corporations: understanding the issues and types of multinational co-operation between individual countries (bilateral co-operation), co-operation between international markets and global co-operation.
4. International competitiveness: knowing the issues of competitiveness and

how to be competitive in the international arena.

5. Quality assurance: familiarity with the auditing, checking, assessment procedures/ processes of the company.
6. Insurance: understanding issues of one's protection, rights and liability within the international arena.
7. Warranties: understanding contractual obligation in terms of conditions and liabilities of products and services.
8. Bidding procedures: ability to prepare a business offer/agreement which will be internationally competitive and comprise all contractual elements.

3.3.6. The International/National History and Culture

The international and national history and culture include the followings.

1. Common history: understanding the history of humankind and the relationships between people and nations.
2. National history and development: understanding one's own national evolution and history.
3. Cultural differences: appreciation and acceptance of other cultures.
4. Economic and political issues: knowledge of national and international economics and political structures and their relationships.
5. Social life and customs: understanding the development of social life and customs.
6. Gender: appreciation and promotion of the equality of both sexes.
7. Religion: understanding of different religious beliefs and practices.
8. Multiculturalism: understanding the diversity of cultures, people and lifestyles.

3.3.7. Proficiency in Languages

Proficiency in languages is defined to embrace:

1. Spoken foreign language fluency: ability to speak and understand other languages (bilingual or multilingual skills).
2. Written foreign language fluency: ability to read and write in other languages.
3. Regional dialects: familiarity with spoken languages peculiar to a region.
4. Technical terminology: understanding of technical terms commonly used

in the field.

5. Professional jargon: understanding of the informal language commonly used in engineering.

3.4. Target Population for the Interview

A target population is referred to the total number of units or items in any field of research or a full set of cases, from which a sample can be taken. The desired population is First Year to Sixth Year Civil Engineering students from Technological University (Myitkyina). The sample size is approximate to the target population.

3.5. Measurement Scales

The students grade their confidence themselves for each attribute on the likert scale of (0 to 10) where 0 means no confidence, 5 represents average confidence and 10 displays full confidence level.

3.6. Analyzing Data

Data analysis involves summarizing the data and interpreting their meaning in a way that provides clear answer to questions that initiated the survey. Often, it consists of interpreting tables and various summary measures with the calculation of central tendencies. The analysis are carried out to describe the observed units, in which case all tools from elementary and intermediate statistics are available (tables, diagrams and charts, etc.). Data analysis may be restricted to the survey data alone or it may compare the survey' estimates with results obtained from other surveys or data sources. It consists of examining tables, charts and various summary measures, such as averages to summarize the data.

3.7. Sampling

The sampling technique used for this study is non-probability sampling, and the method used to draw the sample is purposive sampling for the interviews and convenience sampling for surveying.

Purposive sampling technique allows the judgment of the researcher to select participants that would be the best answers for the research questions and the meeting of objectives. This study used purposive sampling in order to concentrate on individuals who have management knowledge about the construction industry. Only

individuals who hold senior management positions in the construction companies, and university are chosen for the study.

3.8. Data Collection Instrument for Interviews

The procedure followed in the interviews is that of semi-structured interviews where a set of interview questions which are self-designed, are used to guide the interview; however, it is important not to structure the interview too much so as to maintain the narration. The interviews are recorded to ensure that the data are preserved; to ease the interviewing process and to protect the privacy of the interviewees.

3.9. Transcribing Interviews

The research is initially conducted from an inductive perspective where the theory is built up from the data explored. After conducting the interviews and transcribing these verbatim into word-processed text, the data are summarized and then ultimately to link the categories in a manner that provides structure to answer the research question. Once in written form, the transcript is continuously read until dominant themes emerged and thus meanings are developed from the transcripts. The transcription is double-checked for errors, a process known as data cleaning. The set list of questions asked is included in the appendix session for easier comparison with participant responses.

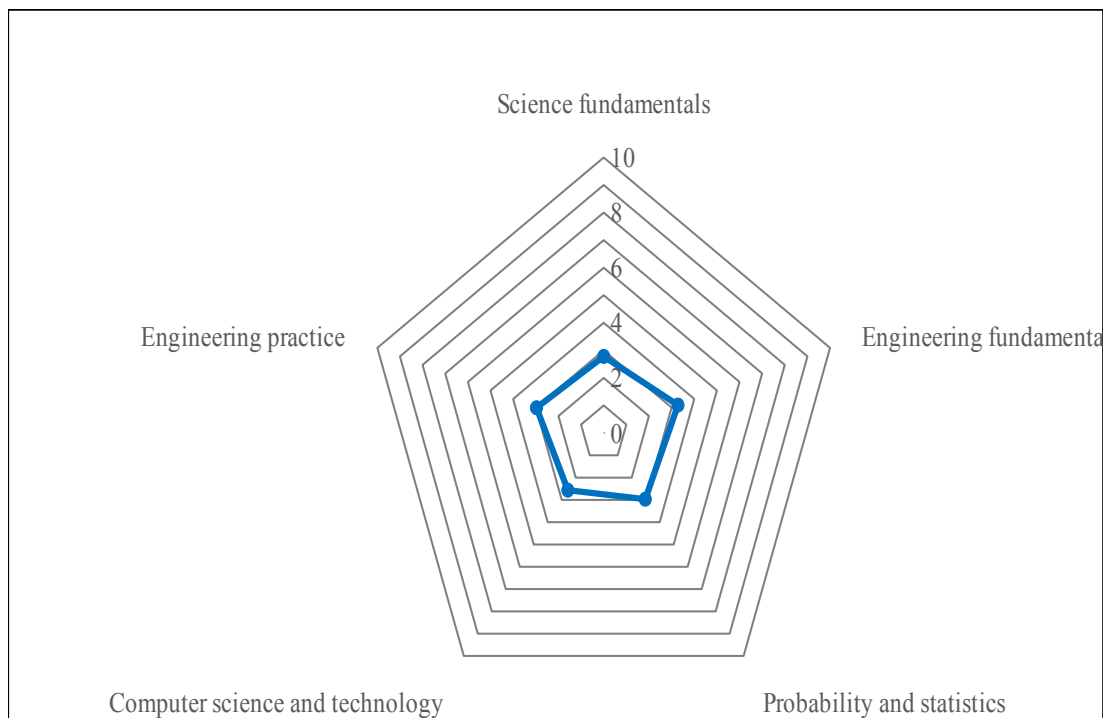
CHAPTER 4

DATA ANALYSIS AND RESULTS

4.1. General

In this chapter, the confidence levels of First Year to Final Year civil engineering students on crucial attributes required for the 21st century dynamic civil engineering workplace are analyzed. The results are depicted in figures for more clear understanding.

4.2. Results



4.2.1. Technical Knowledge and Skills

Figure 4.1. First Year Students' Confidence Index on Technical Knowledge and Skills

The Fig 4.1. shows the confidence levels of First Year Civil Engineering students on 'Technical Knowledge & Skills'. In this figure, it can be seen that 'Engineering Practice' and 'Probability and Statistics' are exactly at the confidence levels of 3. 'Engineering Fundamentals and Application' is a little more than other skills.

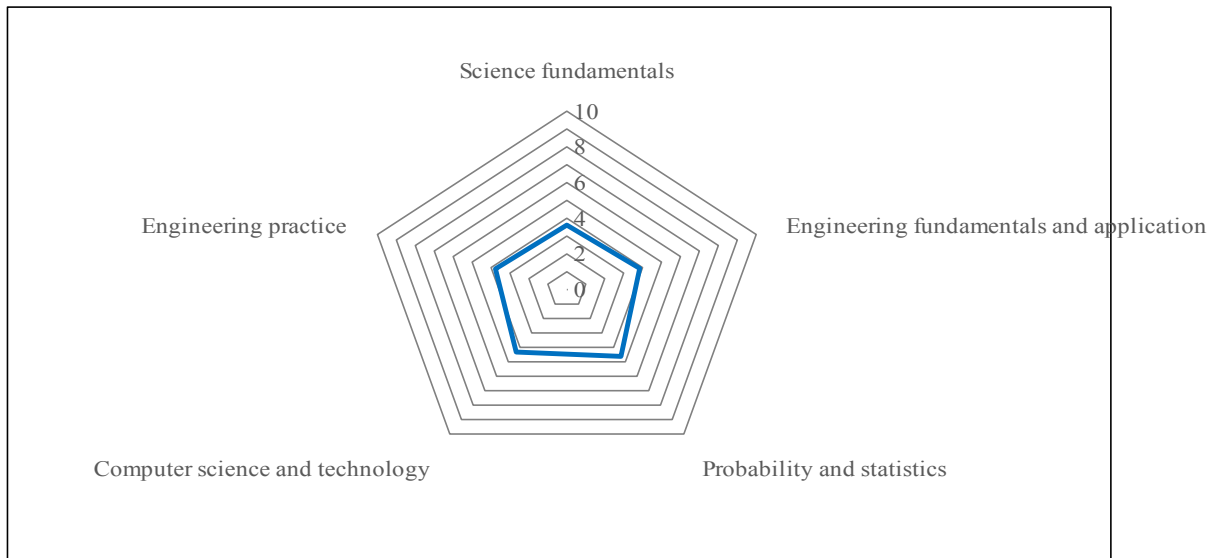


Figure 4.2. Second Year Students' Confidence Index on Technical Knowledge and Skills

The Fig 4.2. demonstrates the confidence levels of Second Year Civil Engineering students on Technical Knowledge & Skills. The confidence level of 'Engineering Practice' and 'Engineering Fundamentals and Application' are nearly 4. Although 'Computer Science and Technology' is the level above 4, 'Science Fundamentals' has only 3.8.

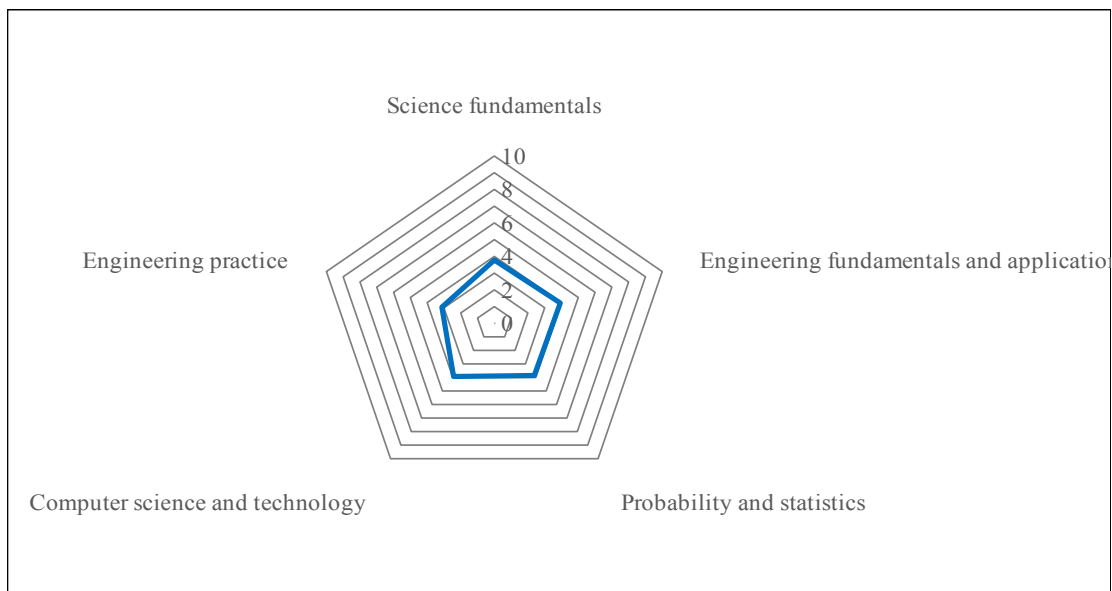


Figure 4.3. Third Year Students' Confidence Index on Technical Knowledge & Skills

This chart provides the confidence level of Third Year Civil Engineering students on Technical Knowledge & Skills. In this chart, it can be seen that 'Engineering Practice' is the poorest confidence level. And all the remaining skills get better results than the previous one. Their confidence level is 4.

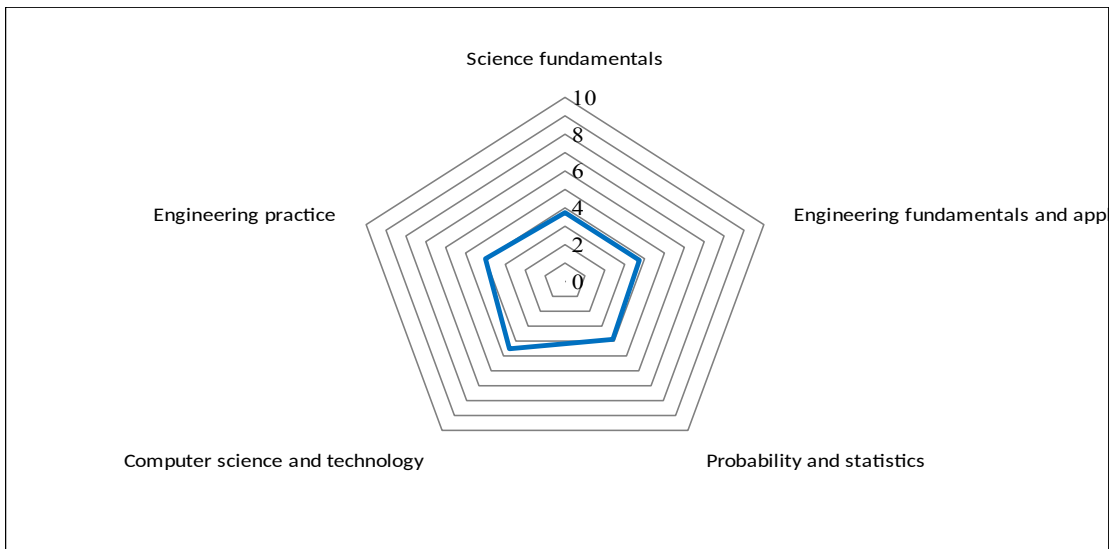


Figure 4.4. Fourth Year Students' Confidence Index on Technical Knowledge & Skills

This figure expresses the confidence levels of Fourth Year Civil Engineering students on Technical Knowledge & Skills. In this figure, it can be seen that 'Computer Science and Technology' is the best confidence level of 4.5. 'Probability and Statistics' gets the second best result of confidence level, 3.8. The other three skills has nearly the same confidence level of the former skill.

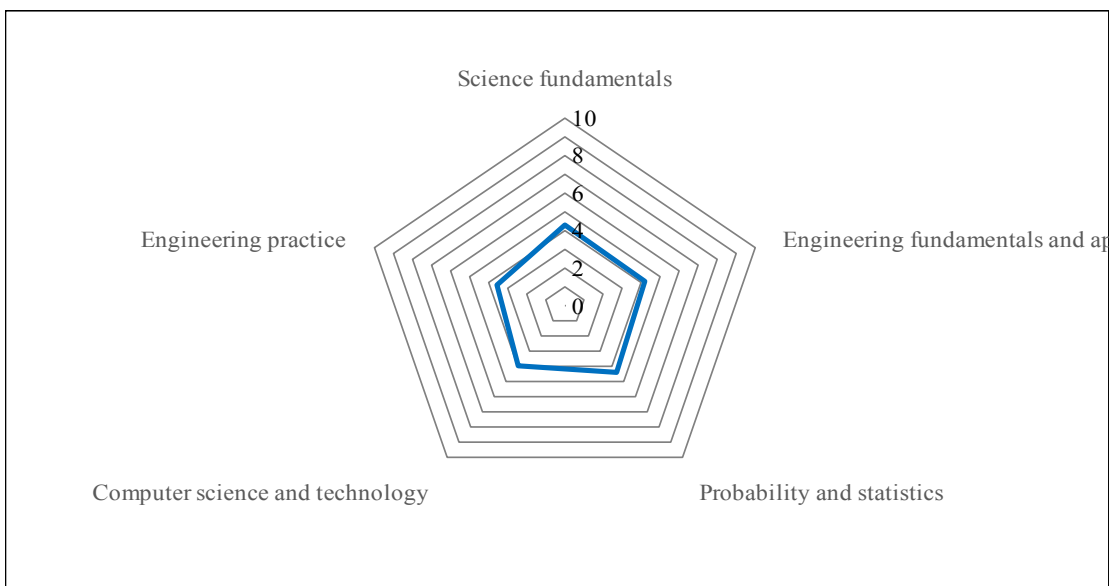


Figure 4.5. Fifth Year Students' Confidence Index on Technical Knowledge & Skills

This radar offers the confidence levels of Fifth Year Civil Engineering students on Technological Knowledge & Skills. In this radar, it can be seen that the students are a little weak in 'Engineering Practice'. In spite of leveling in 'Probability and Statistics' is slightly stronger than the remaining skills whose propose confidence level of 4.

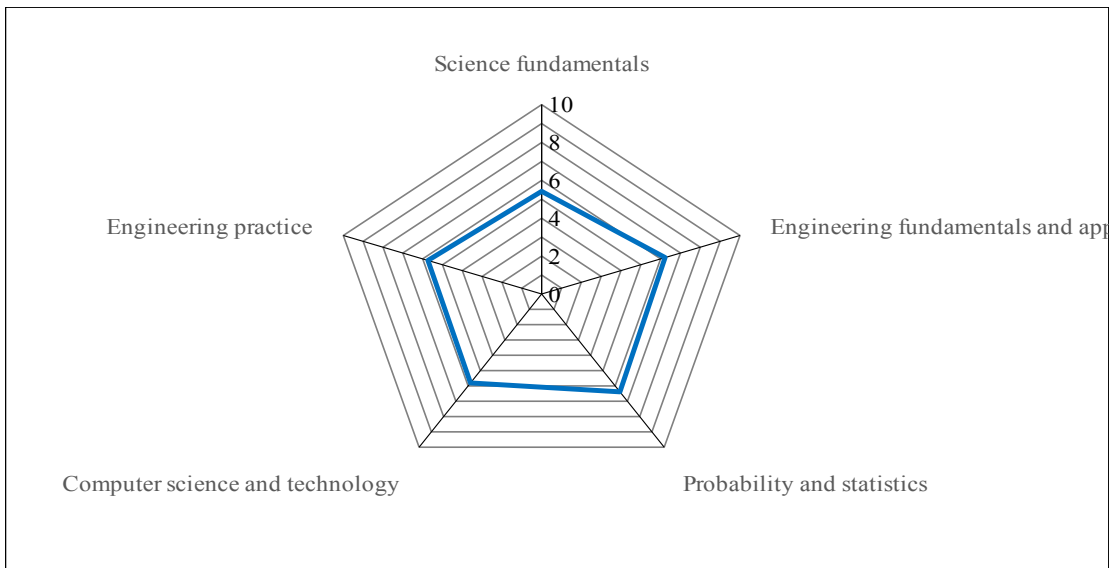


Figure 4.6. Sixth Year Students' Confidence Index on Technical Knowledge & Skills

This chart runs the confidence levels of Sixth Year Civil Engineering students on Technical Knowledge and Skills. As the result, the confidence of all the skills are above 5. Among them, 'Engineering Fundamentals and Application' and 'Probability and Statistics' are confidence level of 6.2 and 6.4. The lasting skills are around 5.5.

4.2.2. Intellectual Skills

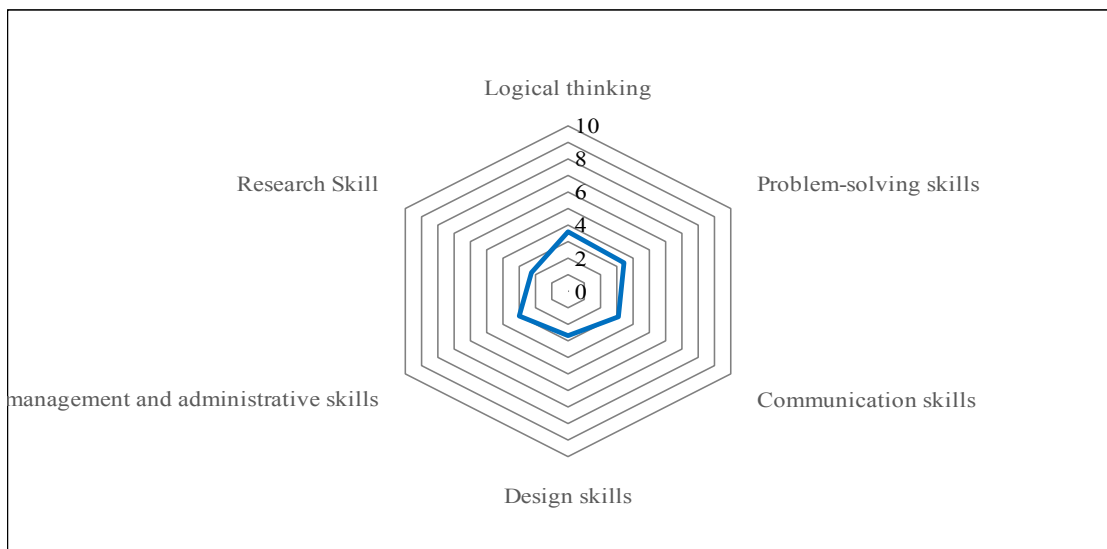


Figure 4.7. First Year Students' Confidence Index on Intellectual Skills

This figure shows the confidence levels of First Year Civil Engineering students on Intellectual Skills. It can be discovered that the confidence level of 'Logical Thinking' is 3.7. 'Problem-Solving Skills' occupies 3.5 of confidence level. And 'Research Skill' is 2.3. The three remaining skills becomes the level around 3.

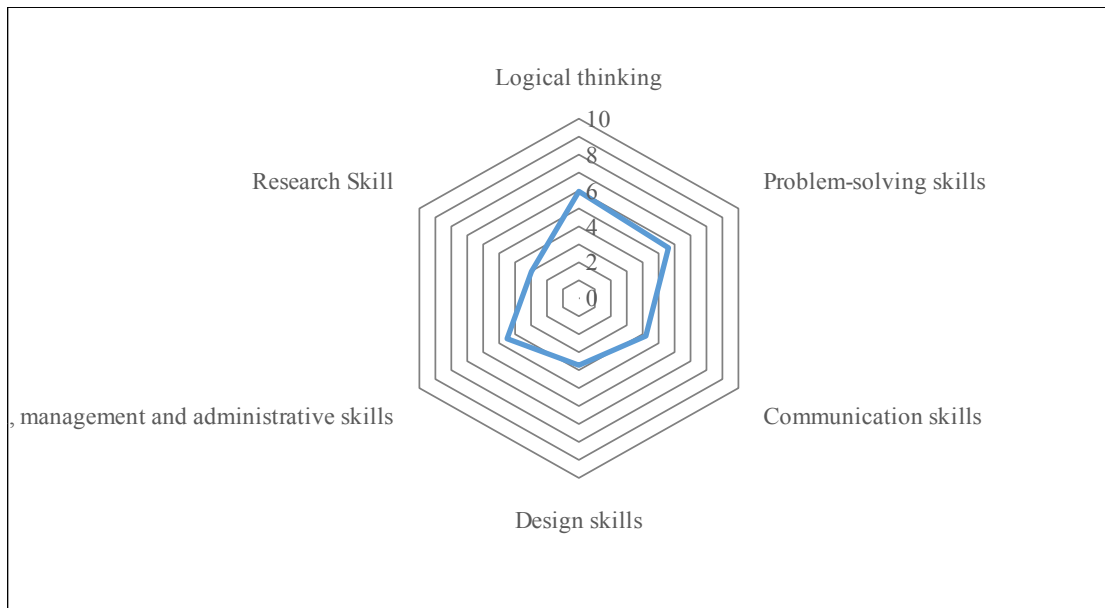


Figure 4.8. Second Year Students' Confidence Index on Intellectual Skills

This radar finds the confidence levels of Second Year Civil Engineering students on Intellectual Skills. 'Research Skill' is the poorest confidence level in this figure. The 'Organizational, Management and Administrative Skills', 'Design Skills' and 'Communication Skills' are the confidence level of 4.5, 3.8 and 4.1.

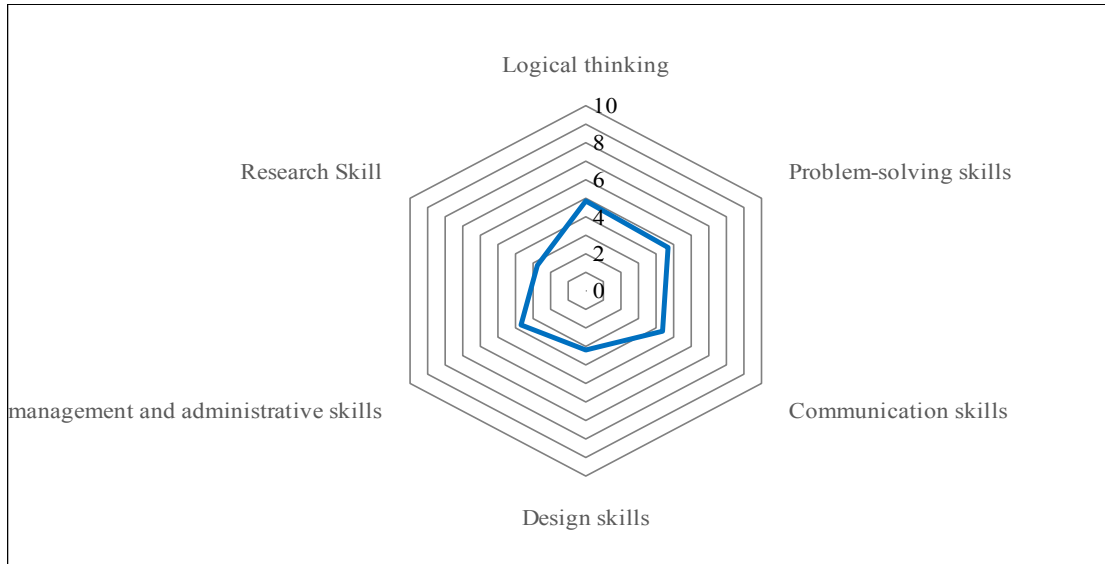


Figure 4.9. Third Year Students' Confidence Index on Intellectual Skills

The above chart illustrates the confidence levels of Third Year Civil Engineering students on Intellectual skills. According to the chart, the students are more confident in 'Logical Thinking' than the other skills. 'Problem-Solving Skills' and 'Communication Skills' are nearly the level of 'Logical Thinking'. The lasting skills run between 3 and 4.

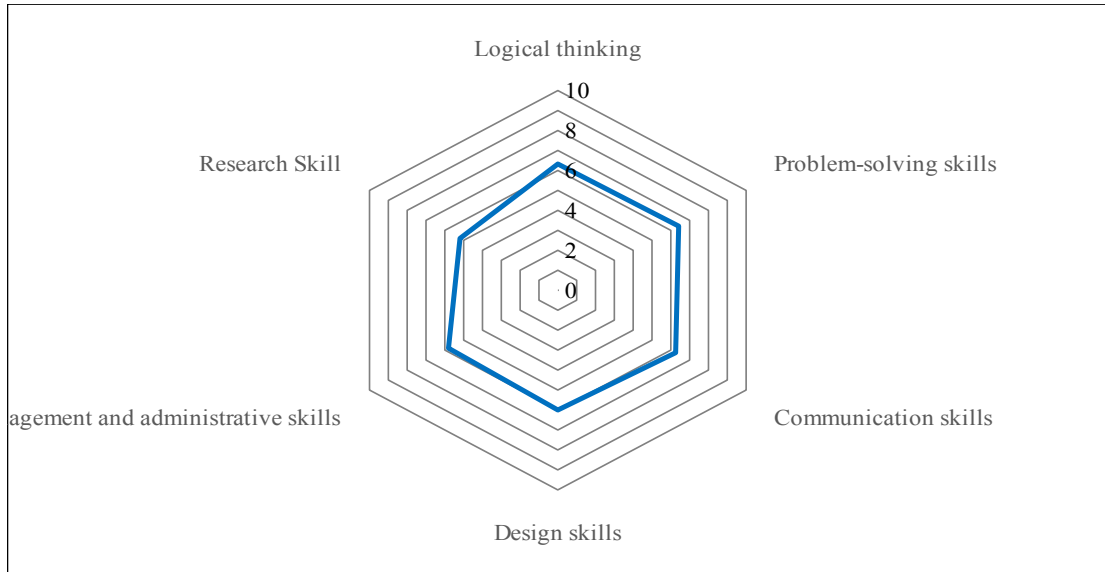


Figure 4.10. Fourth Year Students' Confidence Index on Intellectual Skills

This radar finds the confidence levels of Fourth Year Civil Engineering students on Intellectual skills. 'Organizational Management and Administrative Skills' and 'Design Skills' are almost the same level. Although 'Logical Thinking', 'Problem-Solving Skills' and 'Communication Skills' are the level over 6, 'Research Skill' is only 5.1.

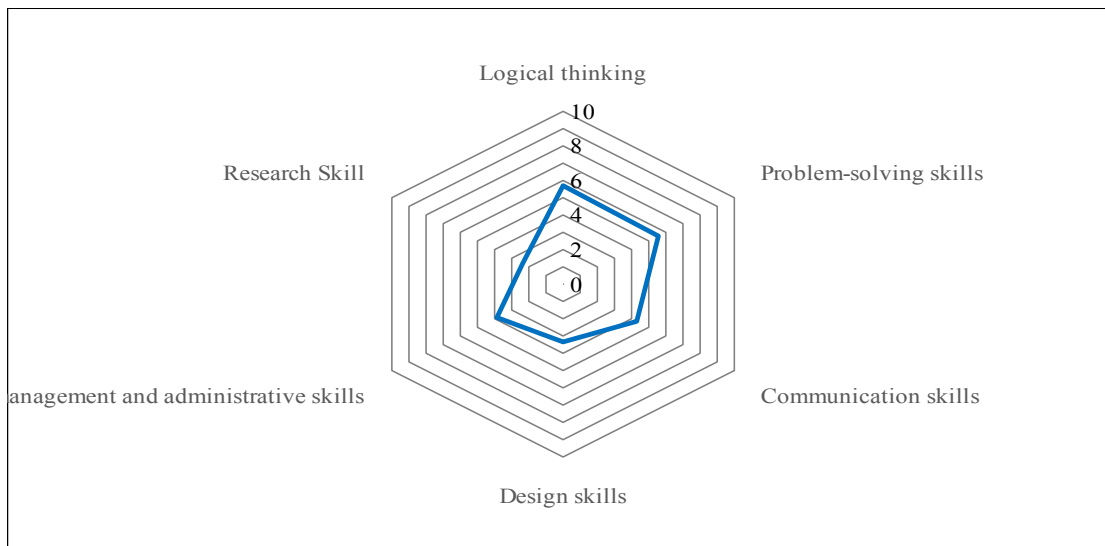


Figure 4.11. Fifth Year Students' Confidence Index on Intellectual Skills

This figure gives the confidence levels of Fifth Year Civil Engineering students on Intellectual Skills. 'Logical Thinking' and 'Problem-Solving Skills' are the confidence level almost 6. 'Communication Skills' obtains 4.3. 'Organizational, Management and Administrative Skills' takes confidence level of 4, 'Design Skills' 3.5 and 'Research Skills' only 1.5.

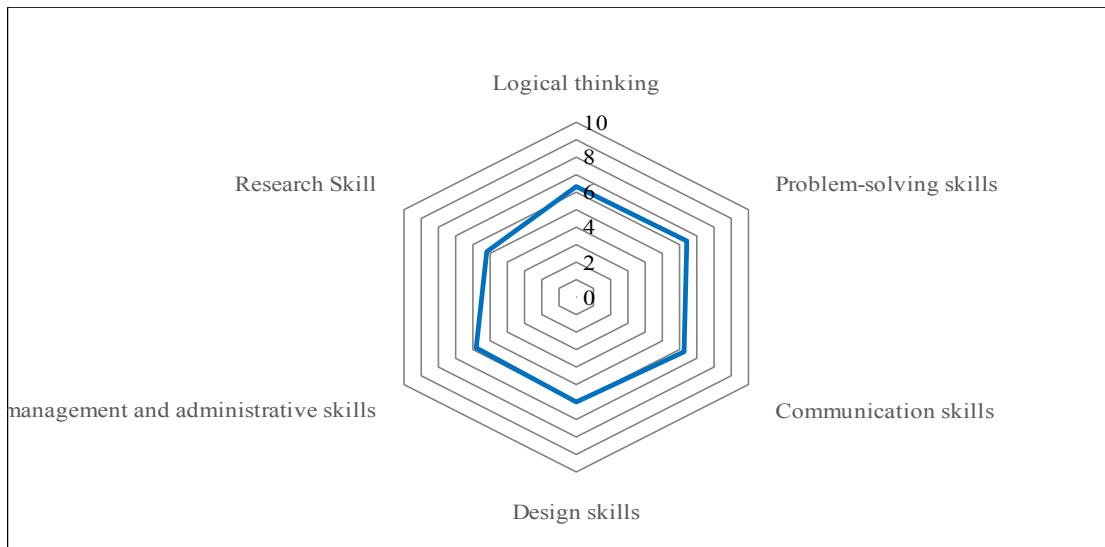


Figure 4.12. Sixth Year Students' Confidence Index on Intellectual Skills

This chart provides the confidence levels of Sixth Year Civil Engineering students on Intellectual skills. According to the chart, 'Logical Thinking', 'Problem-Solving Skills' and 'Communication Skills' are just a little more than 6. And 'Design Skills' takes the confidence level of 6. The two remaining skills are the confidence level of 5.1 and 5.7 respectively.

4.2.3. Attitudes

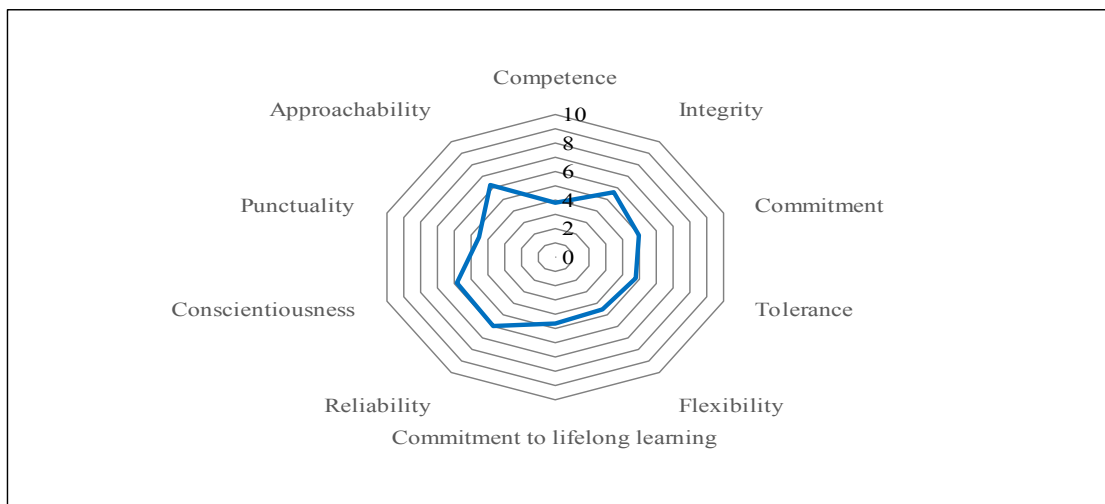


Figure 4.13. First Year Students' Confidence Index on Attitudes

This figure describes the confidence levels of First Year Civil Engineering students on Attitudes. It can be discovered that the confidence level of 'Approachability' and 'Reliability' get over 6. 'Conscientiousness' displays exactly the level of 6. 'Commitment' shows level 5 and then the other four skills are between 4 and 5.

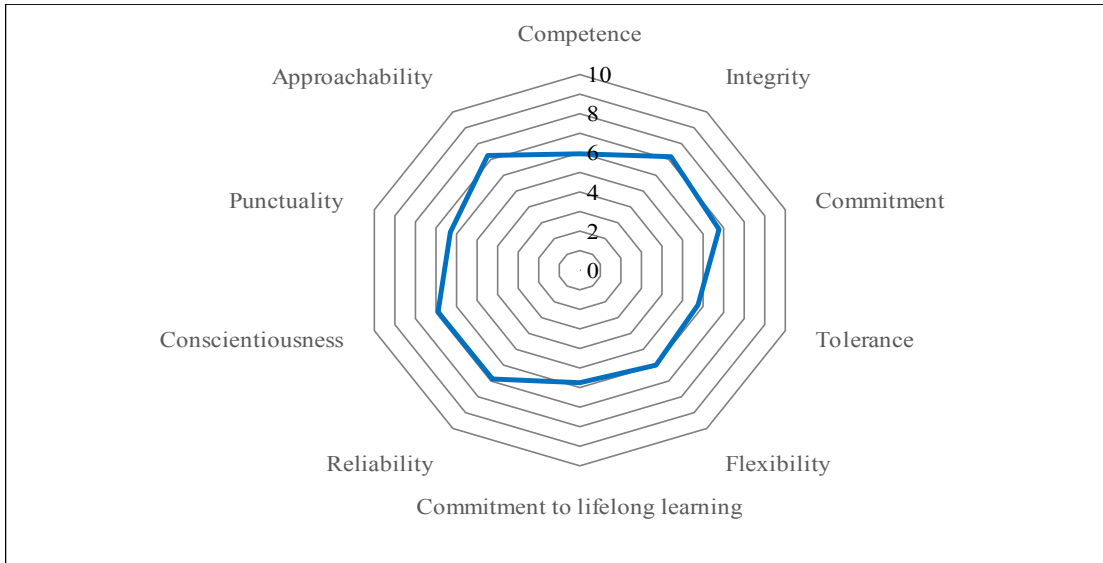


Figure 4.14. Second Year Students' Confidence Index on Attitudes

This chart presents the confidence levels of Second Year Civil Engineering students on Attitudes. In this chart, it can be seen that 'Commitment', 'Tolerance', and 'Commitment to Lifelong Learning' are approximately at the confidence level of 7. Although 'Integrity' and 'Approachability' are the level above 7, 'Punctuality', only 6.2.

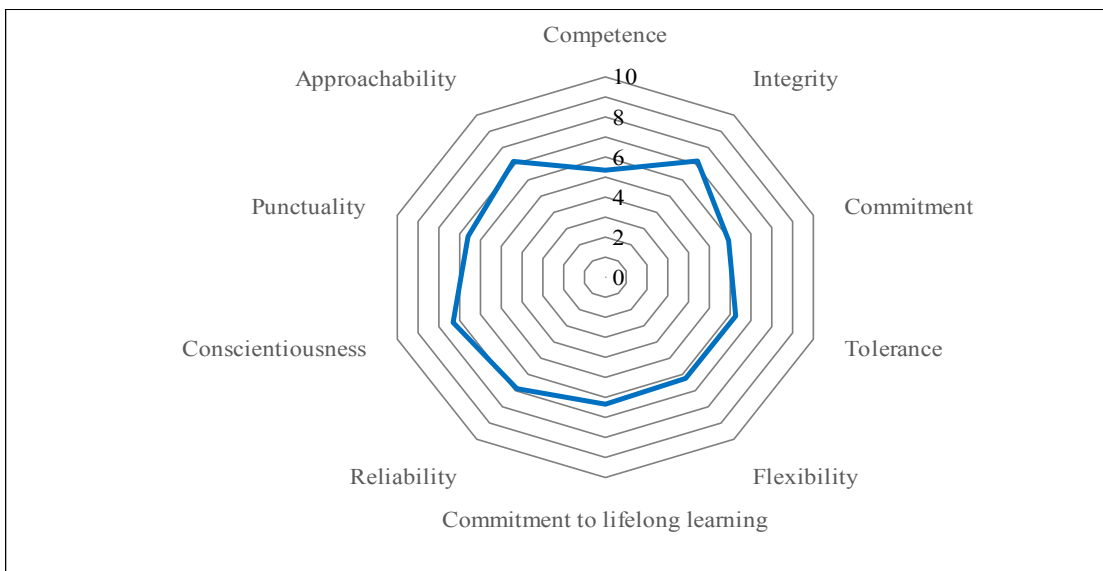


Figure 4.15. Third Year Students' Confidence Index on Attitudes

The Fig 4.15. shows the confidence levels of Third Year Civil Engineering students on Attitude. In this figure, it can be seen that 'Approachability', and 'Reliability' are exactly at the confidence levels of 7. 'Integrity' and 'Conscientiousness' are a little more than other skills. But 'Competence' is the lowest confidence level.

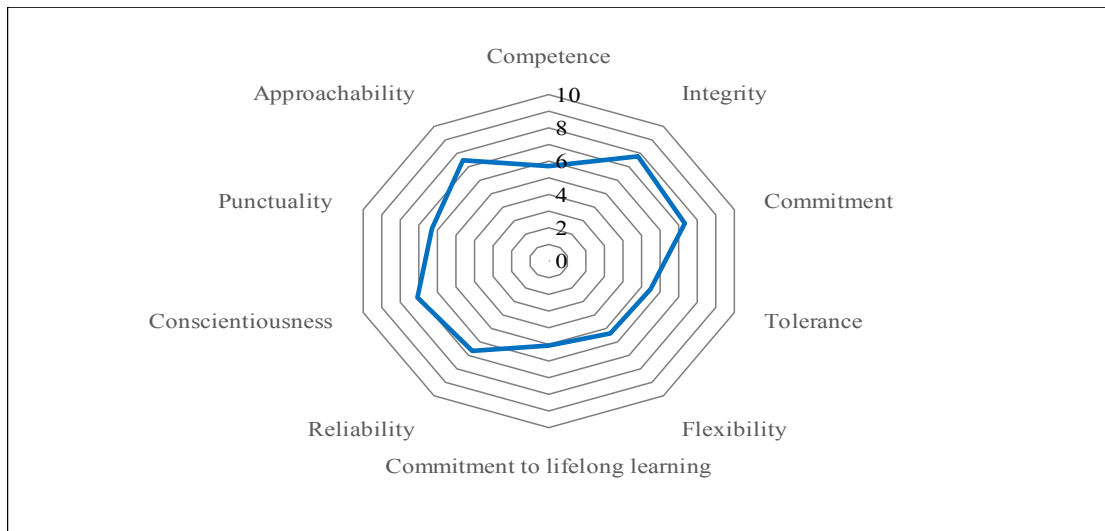


Figure 4.16. Fourth Year Students' Confidence Index on Attitudes

The Fig 4.16. demonstrates the confidence levels of Fourth Year Civil Engineering students on Attitude. In this radar, it can be seen that 'Competence', 'Tolerance', and 'Flexibility' get approximately at the confidence level between 5 and 6. The confidence level of 'Approachability' and 'Commitment' are nearly 7.5. Although 'Integrity' is the level above 8, 'Commitment to Lifelong Learning' is only 5. As the result, the students are the most confident in 'Integrity'.

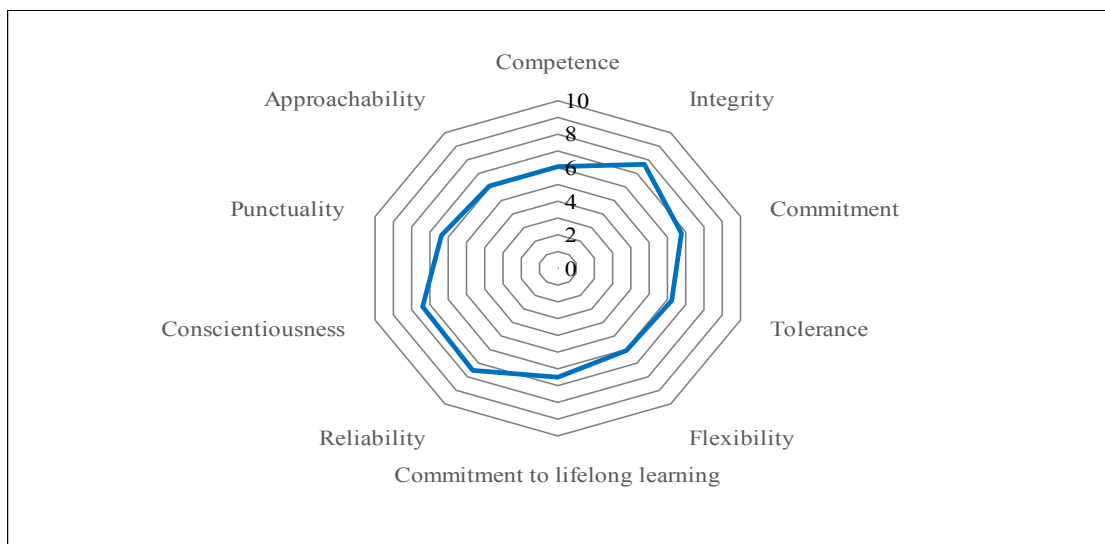


Figure 4.17. Fifth Year Students' Confidence Index on Attitudes

The chart provides the confidence level of Fifth Year Civil Engineering students on Attitude. In this chart, it can be seen that 'Integrity' and 'Reliability' are nearly the level of 8. 'Punctuality', 'Commitment', and 'Commitment to Lifelong Learning' obtain above the level 7. 'Approachability', 'Flexibility', and 'Tolerance' reach the same level of 6.

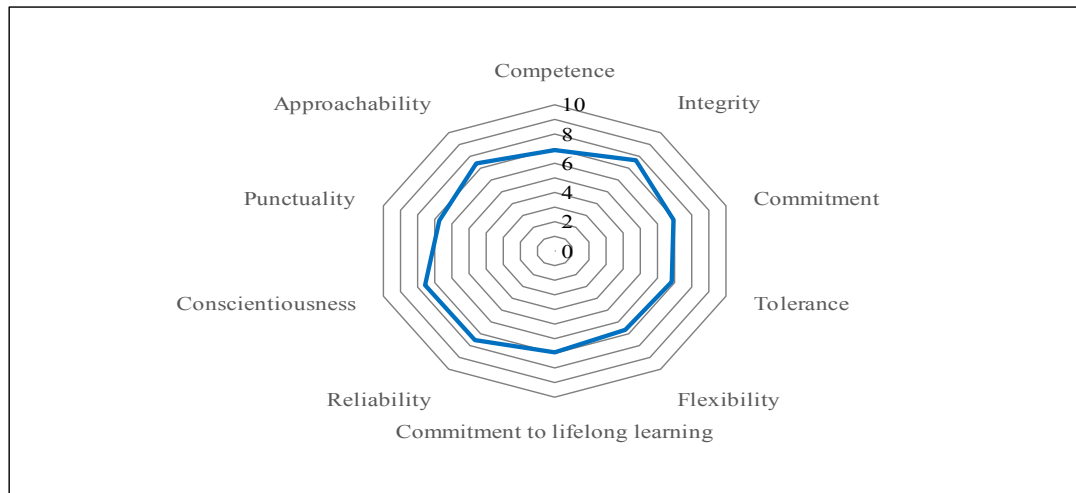


Figure 4.18. Sixth Year Students' Confidence Index on Attitudes

This figure expresses the confidence levels of Sixth Year Civil Engineering students on Attitude. In this figure, it can be seen that 'Integrity' has the best confidence level of 7.6. 'Reliability', 'Conscientiousness' and 'Approachability' get the second best result of confidence level 7.5. The other four skills reach nearly the same confidence level of the former skills. 'Punctuality' is the poorest confidence level.

4.2.4. Standards of Engineering Practice

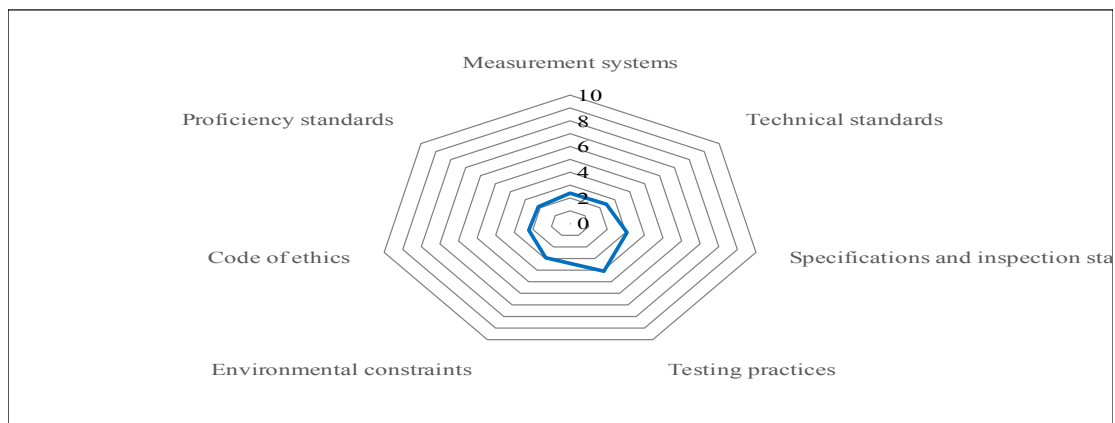


Figure 4.19. First Year Students' Confidence Index on Standards of Engineering Practice

This radar offers the confidence levels of First Year Civil Engineering students on Standards of Engineering Practice. In this radar, it can be seen that the students are a little weak in 'Code of Ethics', 'Proficiency Standards', 'Measurement Systems' and 'Technical Standards'. In spite of leveling in 'Testing Practices' is slightly stronger than the remaining two skills whose propose confidence level of 3.

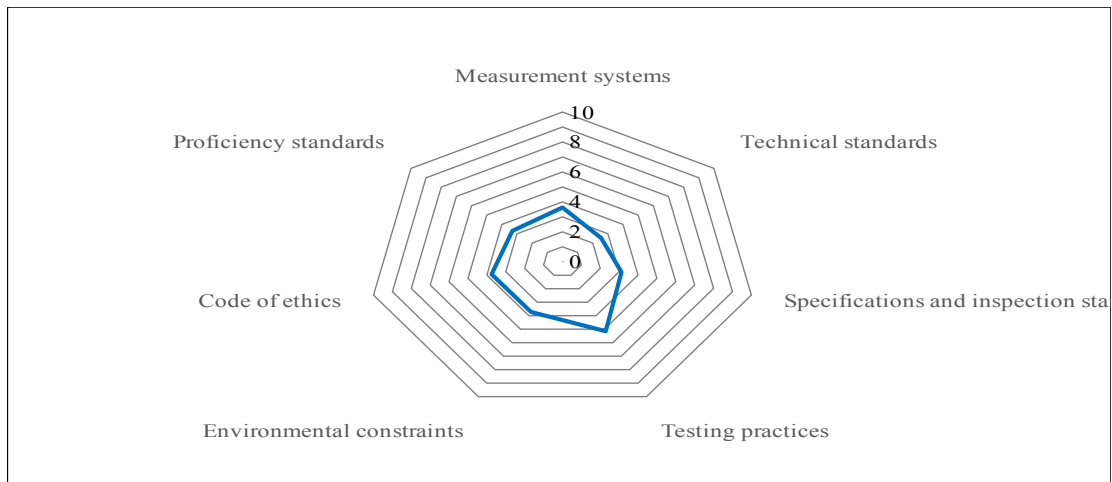


Figure 4.20. Second Year Students' Confidence Index on Standards of Engineering Practice

This chart runs the confidence levels of Second Year Civil Engineering students on Standards of Engineering Practice. As the result, the confidence of all the skills are above 3. Among them, 'Measurement Systems', 'Specifications and Inspection Standards', and 'Environmental Constraints' reach confidence level of 4. The lasting skills get around 5.

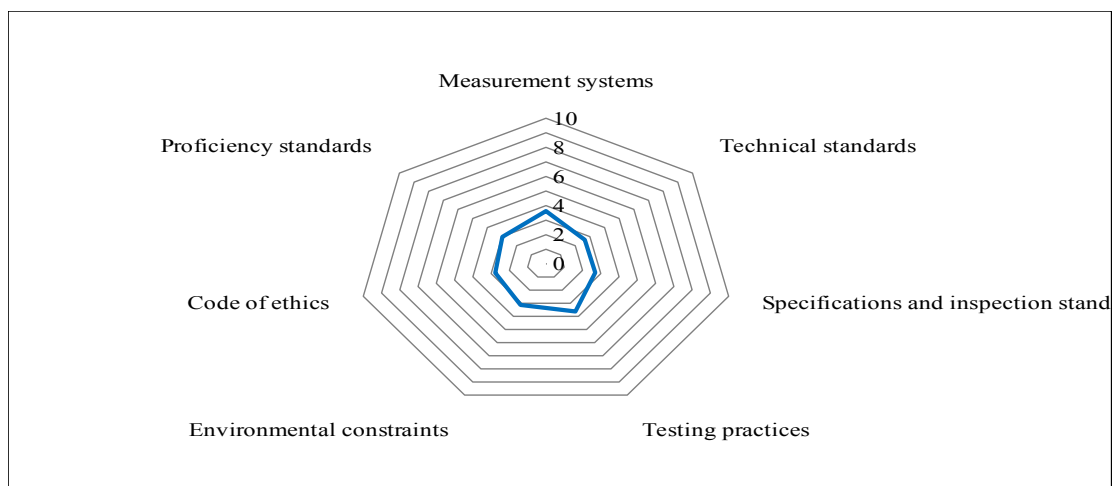


Figure 4.21. Third Year Students' Confidence Index on Standards of Engineering Practice

The figure shows the confidence levels of Third Year Civil Engineering students on Standards of Engineering Practice. It can be discovered that the confidence level of 'Testing Practices' and 'Measurement Systems' are 3.7. 'Code of Ethics' and 'Specifications and Inspection Standards' occupy 2.7 of confidence

level. And 'Environmental Constraints' gets 3.1. The two remaining skills becomes the level around 3.

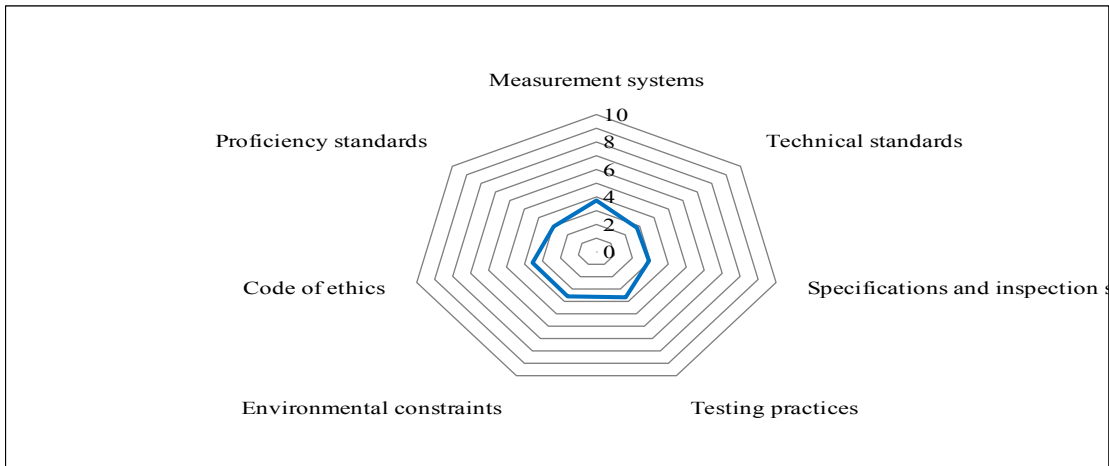


Figure 4.22. Fourth Year Students' Confidence Index on Standards of Engineering Practice

This radar found the confidence levels of Fourth Year Civil Engineering students on Standards of Engineering Practice. 'Proficiency', 'Technical Standards' and 'Specifications and Inspection Standards' take the confidence level of 3 in this figure. 'Code of Ethics', 'Environmental Constraints', and 'Testing Practices' are the confidence level around 3.5. The best confidence level in this radar is 'Measurement Systems'.

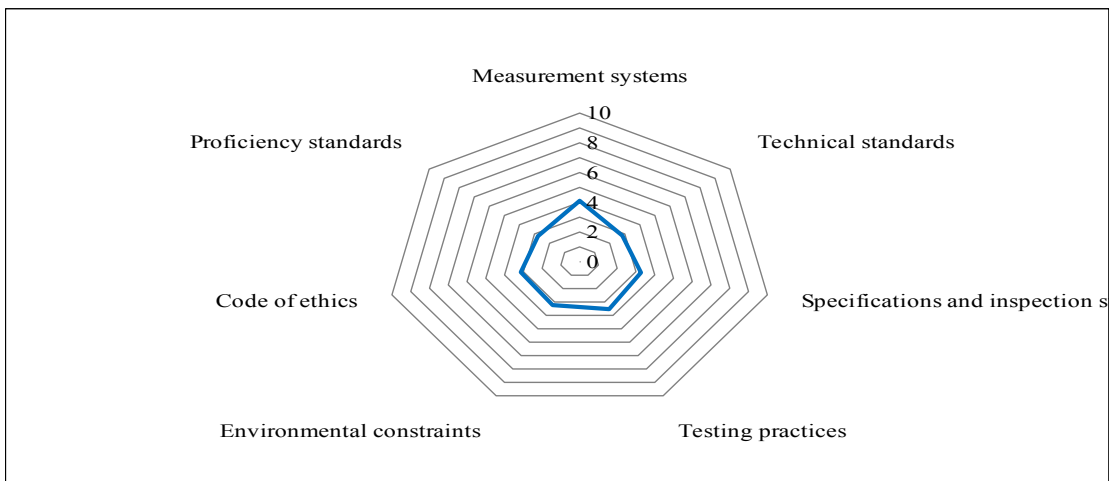


Figure 4.23. Fifth Year Students' Confidence Index on Standards of Engineering Practice

The above chart illustrates the confidence levels of Fifth Year Civil Engineering students on Standards of Engineering Practice. According to the chart, the students are more confident in 'Measurement Systems' than the other skills.

'Testing Practices' is nearly similar the level of 'Measurement Systems'. 'Proficiency Standards', 'Code of Ethics' and 'Technical Standards'. 'Environmental Constraints' and 'Specifications and Inspection Standards' run between 3 and 4.

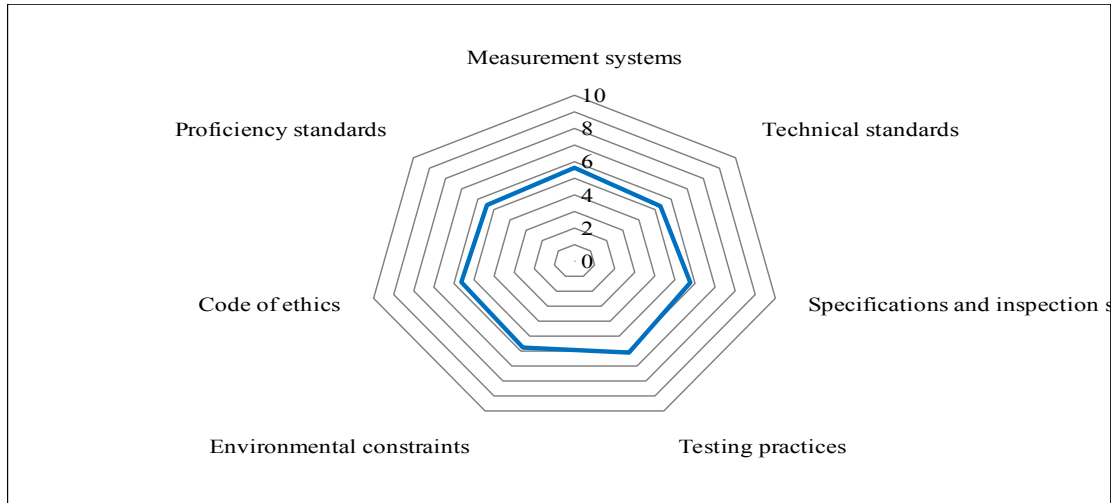


Figure 4.24. Sixth Year Students' Confidence Index on Standards of Engineering Practice

This radar finds the confidence levels of Sixth Year Civil Engineering students on Standards of Engineering Practice. 'Code of Ethics', 'Proficiency Standards', 'Measurement Systems' and 'Technical Standards' are almost the same level. Although 'Testing Practices' reach the level of 6, 'Environmental Constraints' and 'Specifications and Inspection Standards' only 5.7.

4.2.5. Business Practices

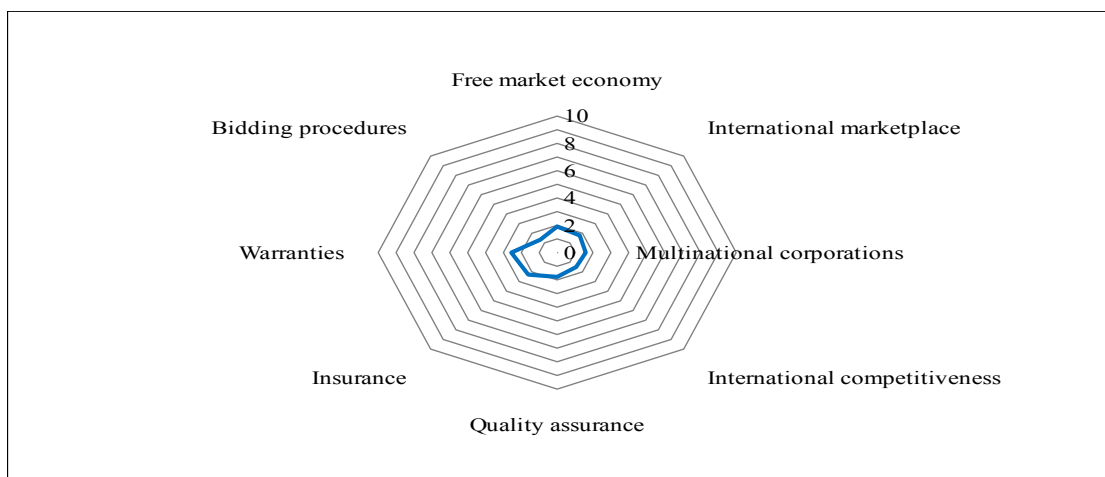


Figure 4.25. First Year Students' Confidence Index on Business Practices

This figure gives the confidence levels of First Year Civil Engineering students on Business Practices. 'Warranties' and 'Insurance' reach the level about 2.5.

'International Marketplace' obtains exactly confidence level of 2. 'International Marketplace', 'Multinational Corporations', 'International Competitiveness', and 'Quality Assurance' takes confidence level between 1 and 2. 'Bidding Procedures' is the lowest level and only has 1.5.

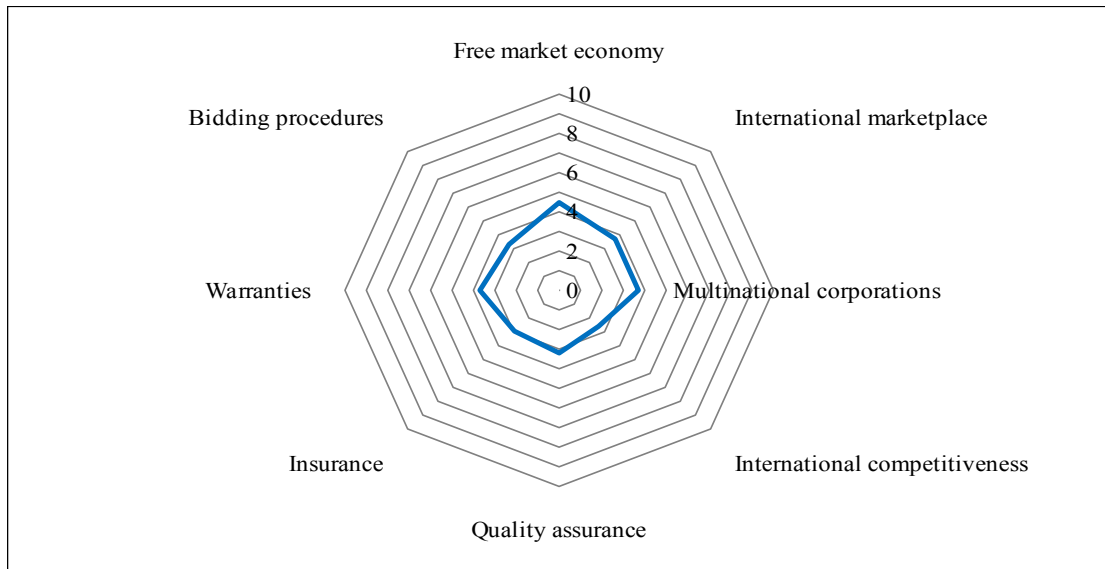


Figure 4.26. Second Year Students' Confidence Index on Business Practices

This chart provides the confidence levels of Second Year Civil Engineering students on Business Practices. According to the chart, 'Free Market Economy' proposes just a little more than 4. 'Warranties', 'International Marketplace' and 'Multinational Corporations' takes the confidence level of under 4. The three remaining skills reach the confidence level of 3, 3.2 and 3.4 respectively.

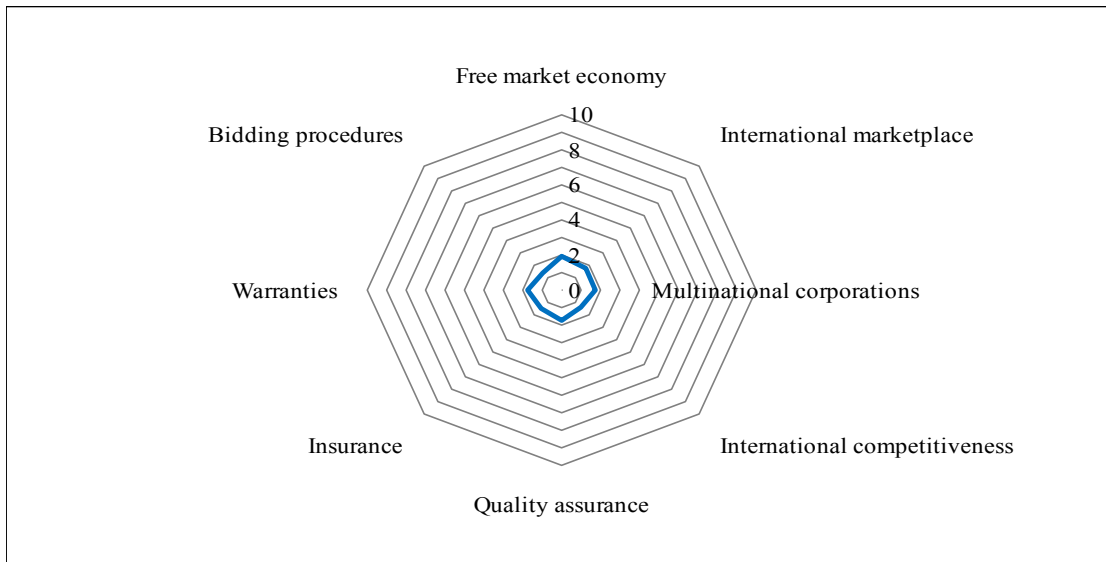


Figure 4.27. Third Year Students' Confidence Index on Business Practices

This figure shows the confidence levels of Third Year Civil Engineering students on Business Practices. In this figure, it can be seen that all the skills contain between 1 and 2. Among them, 'Free Market Economy' comprises the highest skill which gets 1.9. 'Bidding Procedures' is the lowest skill in this figure.

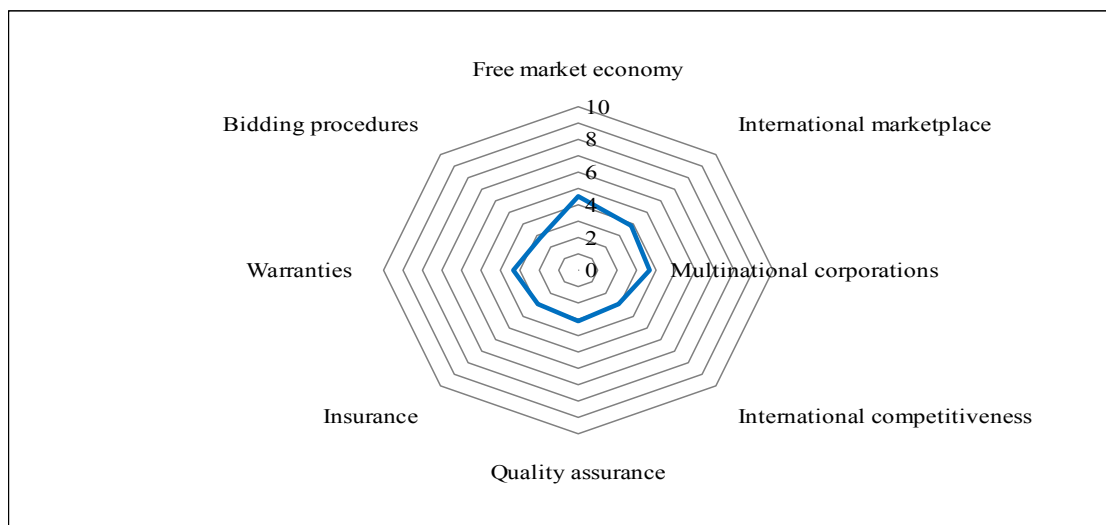


Figure 4.28. Fourth Year Students' Confidence Index on Business Practices

This radar demonstrates the confidence levels of Fourth Year Civil Engineering students on Business Practices. In this radar, it can be seen that Insurance, Quality Assurance and International Competitiveness get approximately at the confidence levels of 3. The confidence level of 'International Marketplace' is nearly 4. Although 'Warranties' and 'Multinational Corporations' reach the level above 3, 'Science Fundamentals' is only 2.8.

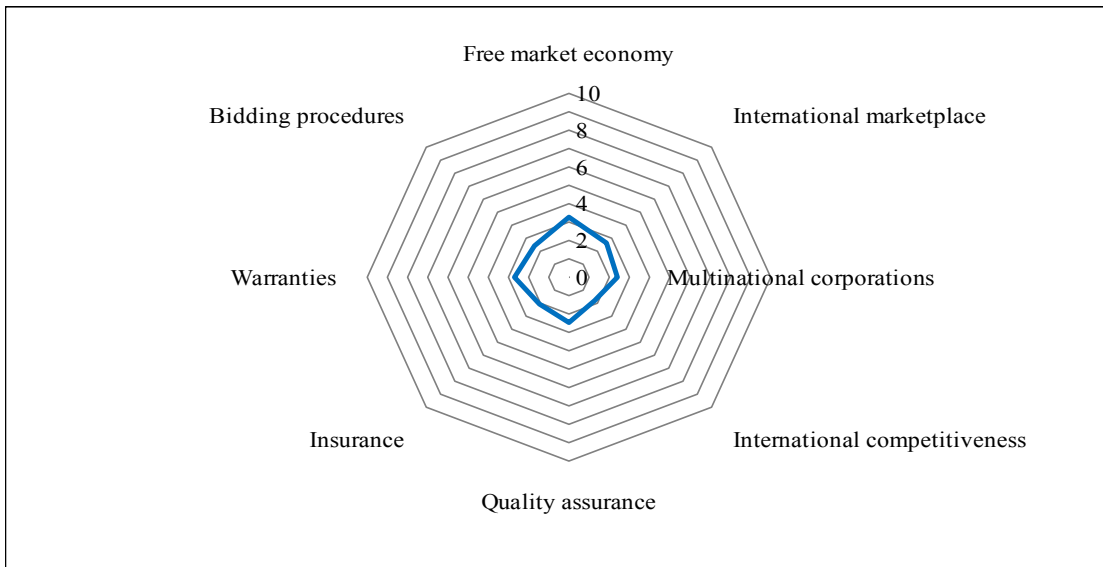


Figure 4.29. Fifth Year Students' Confidence Index on Business Practices

This chart provides the confidence level of Fifth Year Civil Engineering students on Business Practices. In this chart, it can be seen that 'Free Market Economy' gets the highest confidence level. 'Insurance' obtains accurately the confidence level of 2. 'International Competitiveness' is the poorest confidence level. And all the remaining skills get the level between 2 and 3.

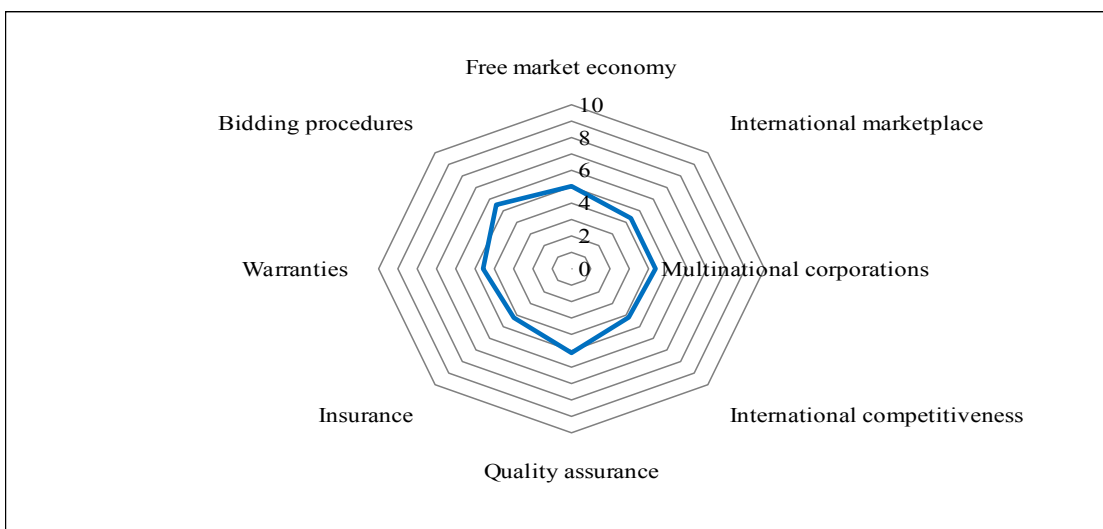


Figure 4.30. Sixth Year Students' Confidence Index on Business Practices

This figure expresses the confidence levels of Sixth Year Civil Engineering students on Business Practices. In this figure, it can be seen that 'Bidding Procedures' is the best confidence level of 5.5. 'Free Market Economy' and 'Quality Assurance' get the second best result of confidence level, 5. The other five skills reach nearly the confidence level between 4 and 5.

4.2.6. International/National History and Culture

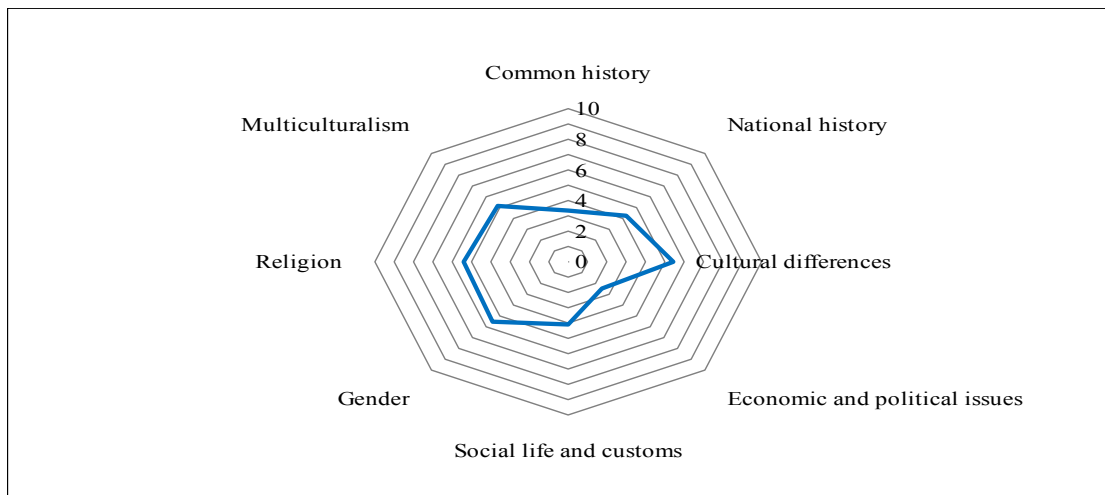


Figure 4.31. First Year Students' Confidence Index on International/National History and Culture

This radar offers the confidence levels of First Year Civil Engineering students on International/National History and Culture. In this radar, it can be seen that the students are a little weak in 'Economic and Political Issues'. In spite of leveling in 'Gender', 'Religion' and 'Cultural Differences' is slightly stronger than the remaining skills whose propose confidence level over 5.

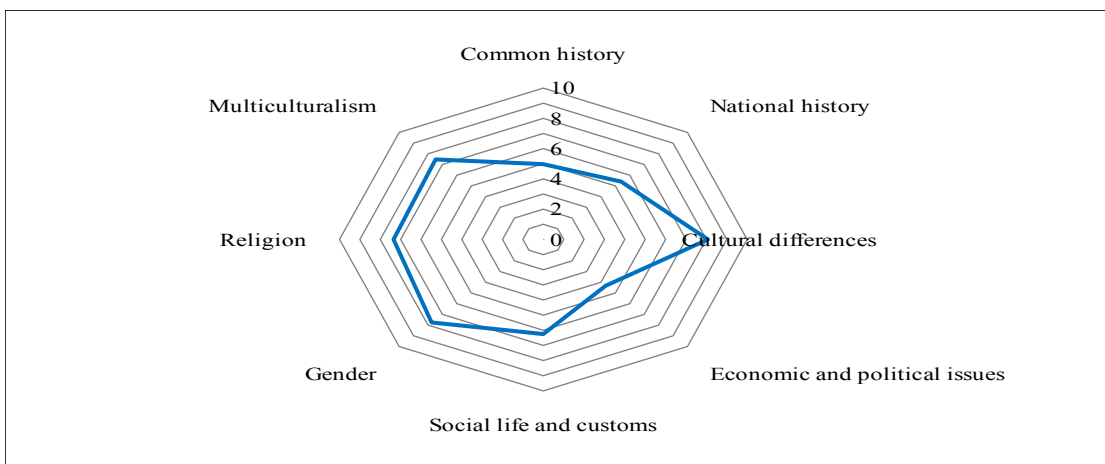


Figure 4.32. Second Year Students' Confidence Index on International/National History and Culture

This chart runs the confidence levels of Second Year Civil Engineering students on International/National History and Culture. As the result, the confidence of all the skills are above 5. Among them, 'Culture Differences' reaches the confidence level of 8. 'Multiculturalism', 'Religion', and 'Gender' occupy the level above 7.5. 'Economic and Political Issues' gets only 4. The lasting skills are below the level of 6.

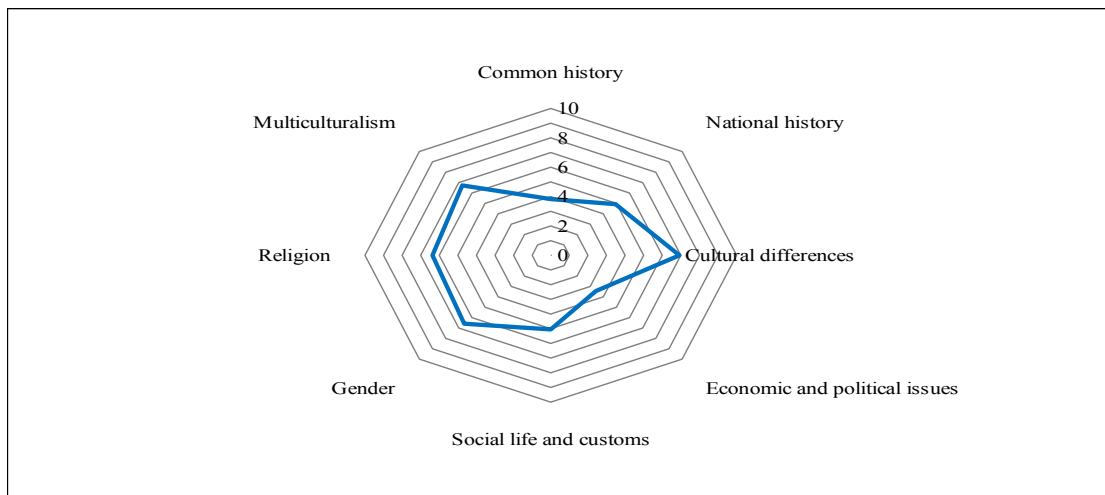


Figure 4.33. Third Year Students' Confidence Index on International/National History and Culture

This figure illustrates the confidence levels of Third Year Civil Engineering students on International/National History and Culture. It can be discovered that the confidence level of 'Common History' and 'Economic and Political Issues' show significantly. 'Cultural Differences' occupies 7 of confidence level. 'National History' and 'Social Life and Customs' get exactly 5. The three remaining skills becomes the level around 6.5.

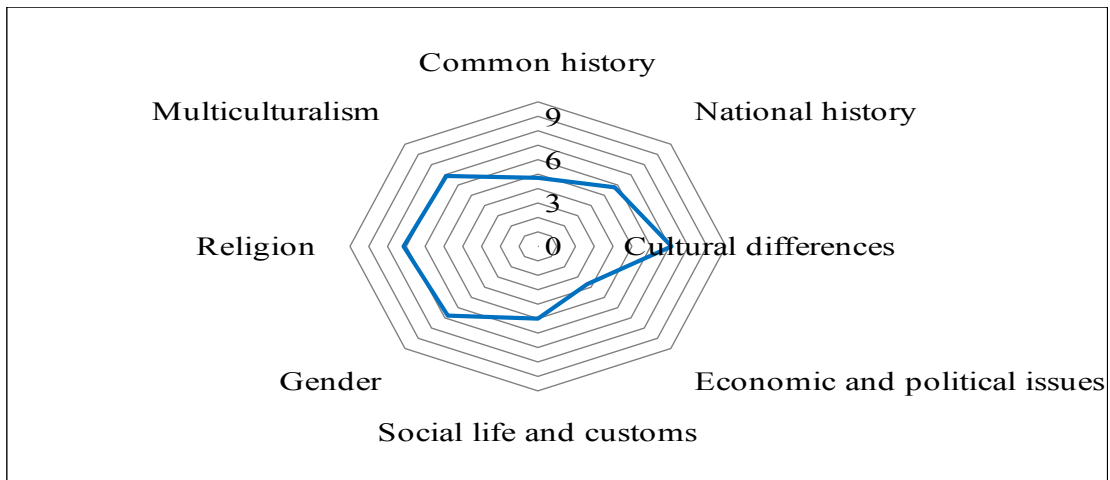


Figure 4.34. Fourth Year Students' Confidence Index on International/National History and Culture

This radar found the confidence levels of Fourth Year Civil Engineering students on International/National History and Culture. 'Economic and Political Issues' is the poorest confidence level in this figure. 'Multiculturalism', 'Religion' and 'Gender' have the same confidence level. The best confidence level in this radar is 'Cultural Differences' which is slightly more than other skills. The two lasting skills reach the level around 5.

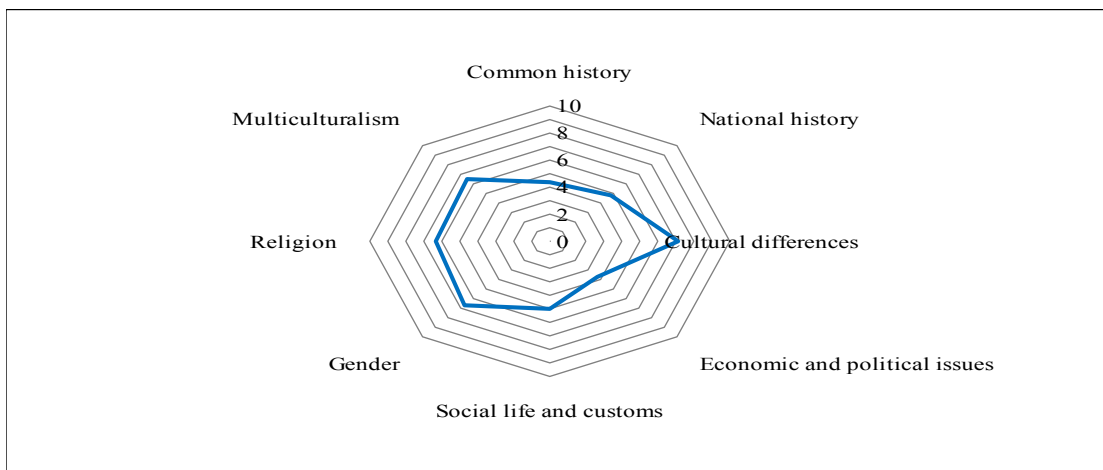


Figure 4.35. Fifth Year Students' Confidence Index on International/National History and Culture

The above chart illustrates the confidence levels of Fifth Year Civil Engineering students on International/National History and Culture. According to the chart, the students are more confident in 'Cultural Differences' than the other skills. In contrast, the lowest one is 'Economic and Political Issues' which is only 3.8. 'Multiculturalism', 'Religion' and 'Gender' are nearly the level of logical thinking. The lasting skills run between 4 and 5.

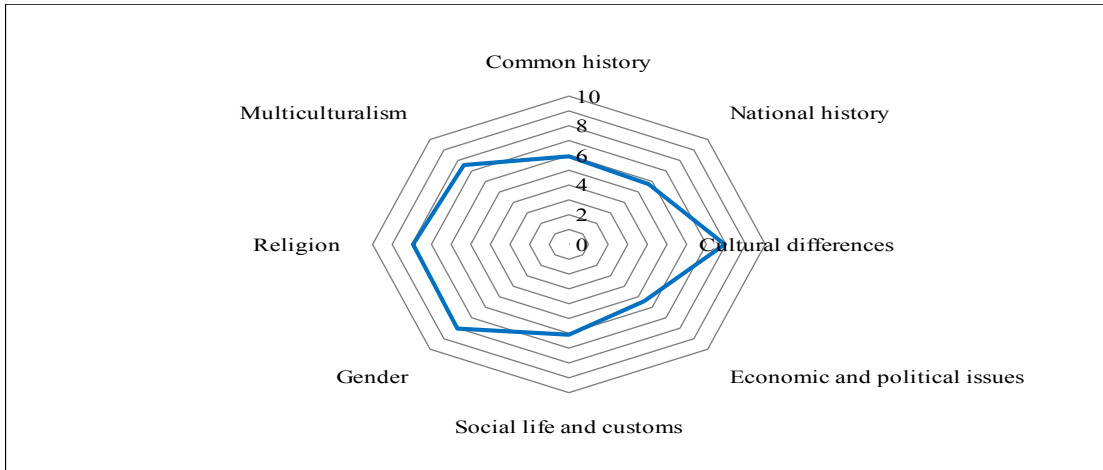


Figure 4.36. Sixth Year Students' Confidence Index on International/National History and Culture

This radar finds the confidence levels of Sixth Year Civil Engineering students on International/National History and Culture. 'Religion, Gender', and 'Cultural Differences' are at the same level. The confidence level of 'Multiculturalism' gets about 6.5. Even though 'Common History' and 'Social Life and Customs' reach the confidence level of 6, 'National History' and 'Economic and Political Issues' get under the level of 5.

4.2.7. Proficiency in Foreign Languages

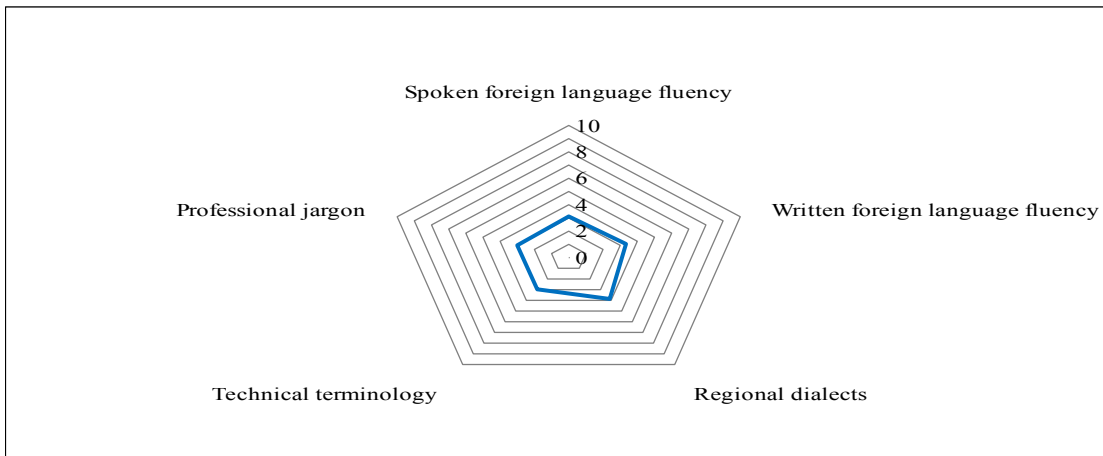


Figure 4.37. First Year Students' Confidence Index on Proficiency in Foreign Languages

This figure gives the confidence levels of First Year Civil Engineering students on Proficiency in Foreign Languages. 'Regional dialects' takes significantly difference from other skills. 'Proficiency in Foreign Languages', 'Professional Jargon' and 'Technical Terminology' obtain 3 confidence level. And 'Written Foreign Language Fluency' takes the confidence level of 4.

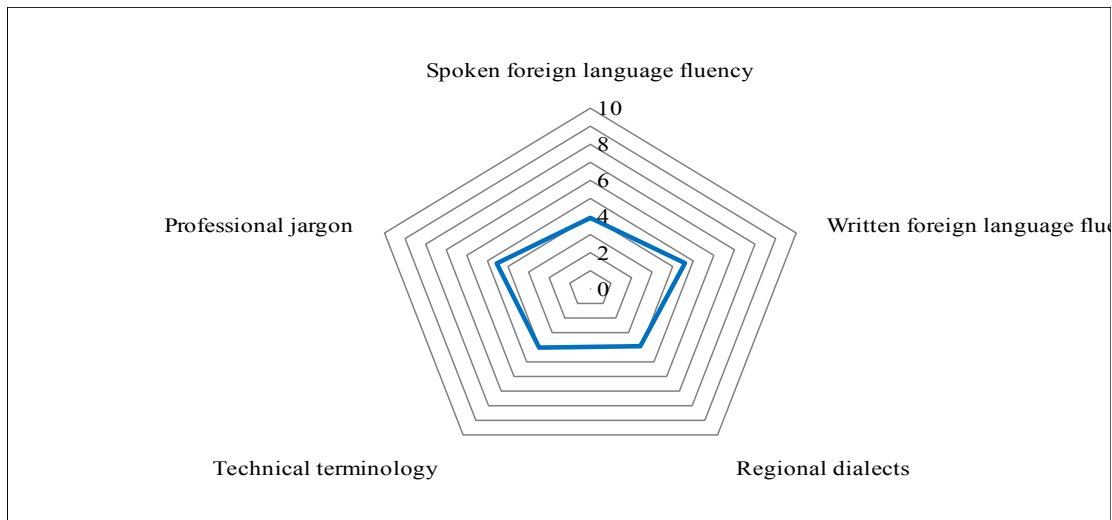


Figure 4.38. Second Year Students' Confidence Index on Proficiency in Foreign Languages

This chart provides the confidence levels of Second Year Civil Engineering students on Proficiency in Foreign Languages. According to the chart, 'Spoken Foreign Language Fluency, Technical Terminology' and 'Regional Dialects' reach the same confidence level. And 'Written Foreign Language Fluency' and 'Professional Jargon' contain the confidence level between 4 and 5.

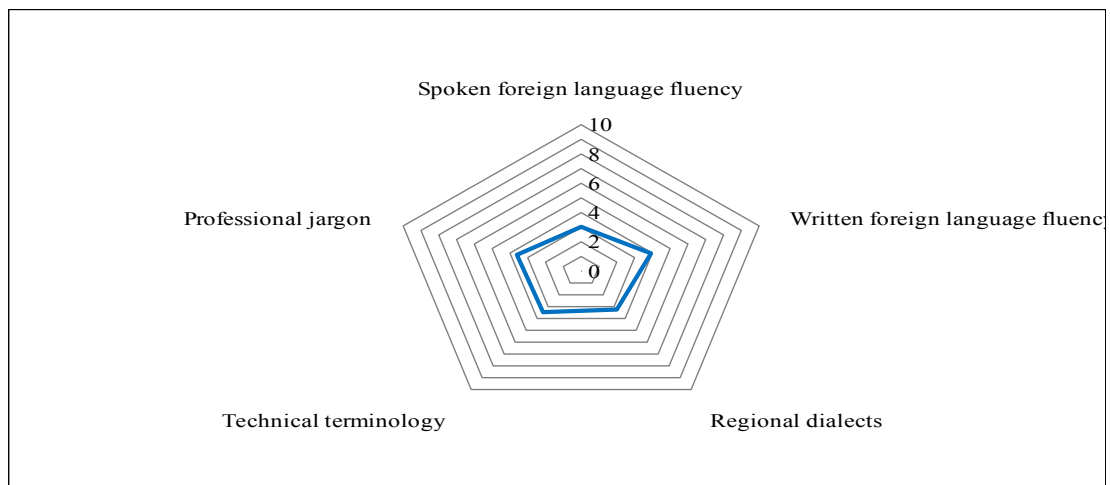


Figure 4.39. Third Year Students' Confidence Index on Proficiency in Foreign Languages

This figure shows the confidence levels of Third Year Civil Engineering students on Proficiency in Foreign Language. In this figure, it can be seen that 'Spoken Foreign Language Fluency' is exactly at the confidence levels of 3. 'Professional Jargon', 'Technical Terminology' and 'Regional Dialects' are around 3.5. 'Written Foreign Language Fluency' is better than other skills which possess accurately the level of 4.

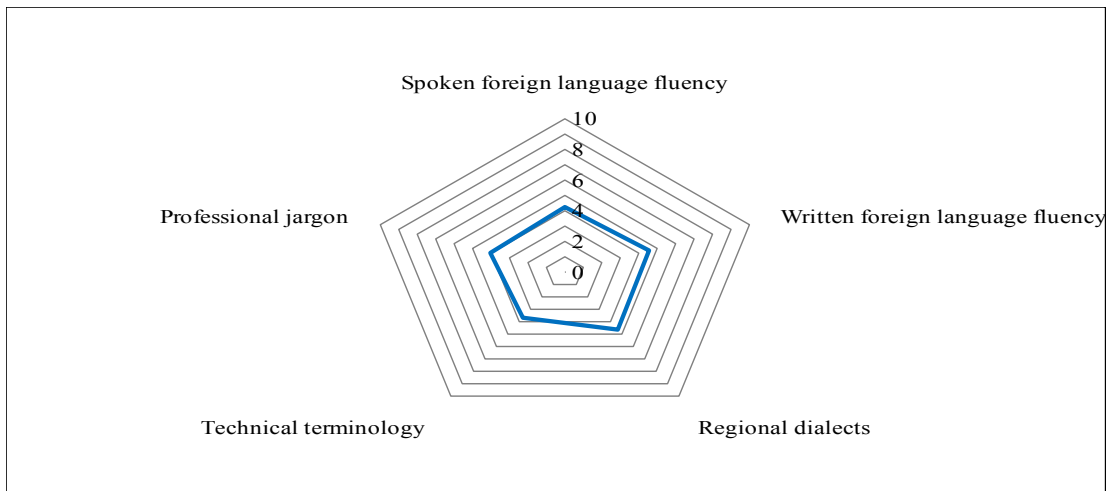


Figure 4.40. Fourth Year Students' Confidence Index on Proficiency in Foreign Languages

This radar demonstrates the confidence levels of Fourth Year Civil Engineering students on Proficiency in Foreign Languages. In this radar, it can be seen that 'Written Foreign Language Fluency' and 'Regional Dialects' have approximately at the confidence levels of 5. The confidence level of 'Professional Jargon' and 'Spoken Foreign Language Fluency' are nearly 4. But 'Technical Terminology' is only 3.8.

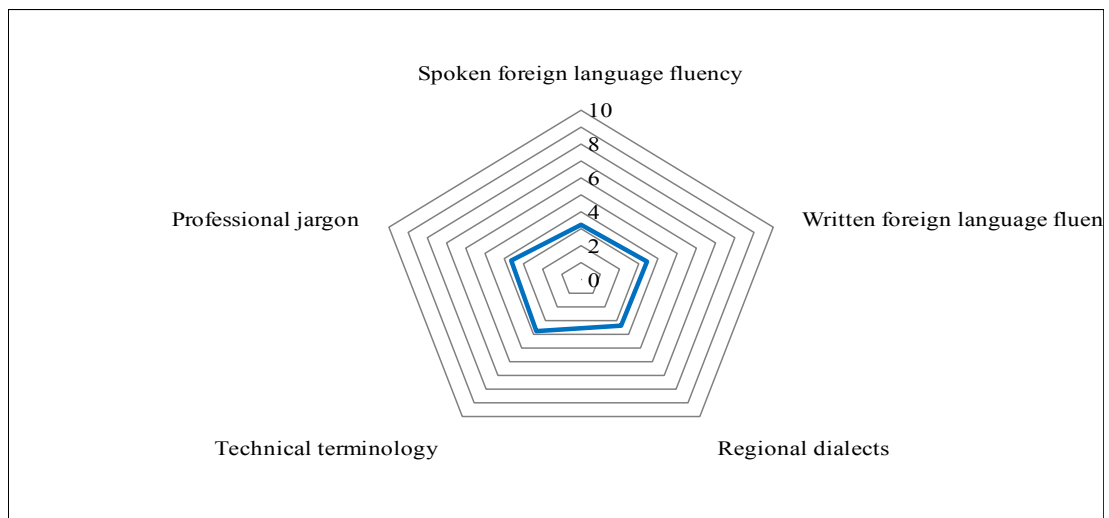


Figure 4.41. Fifth Year Students' Confidence Index on Proficiency in Foreign Languages

This chart provides the confidence level of Fifth Year Civil Engineering students on Proficiency in Foreign Languages. In this chart, it can be seen that all of skills are in the confidence level between 3 and 4. Among them, 'Technical Terminology' get better skill than the other skills. The remaining skills are almost at the same level.

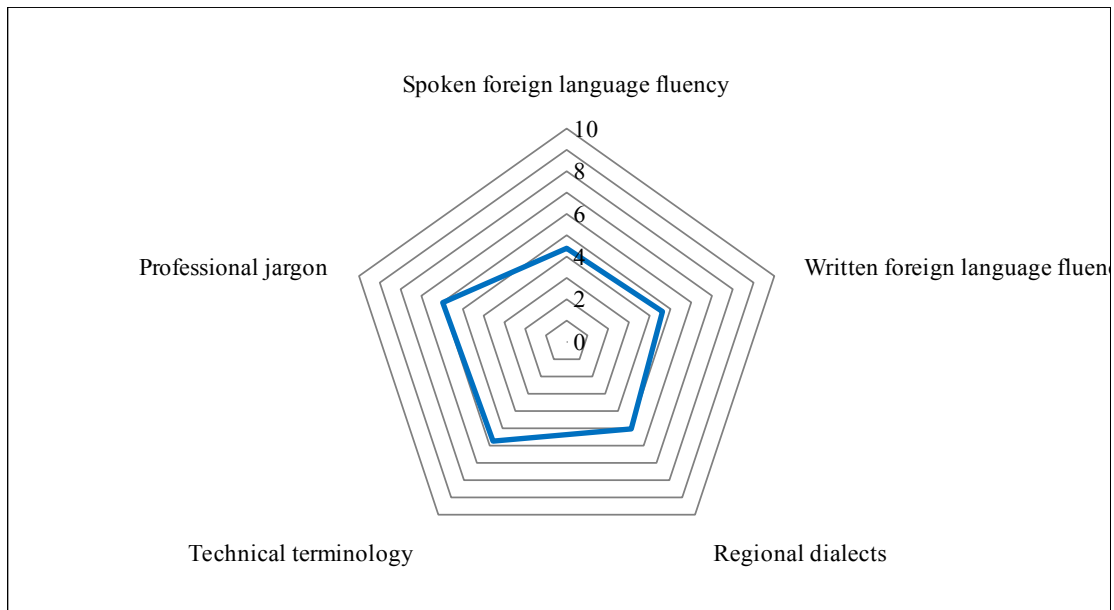


Figure 4.42. Sixth Year Students' Confidence Index on Proficiency in Foreign Languages

This figure expresses the confidence levels of Sixth Year Civil Engineering students on Proficiency in Foreign Languages. In this figure, it can be seen that 'Professional Jargon' has the best confidence level of 6. 'Technical Terminology' gets the second best result of confidence level, 5.8. 'Spoken Foreign Language Fluency' and 'Written Foreign Language Fluency' take the level between 4 and 5. The last skill has accurately the level of 4.6.

4.2.8. Comparison of Confidence levels

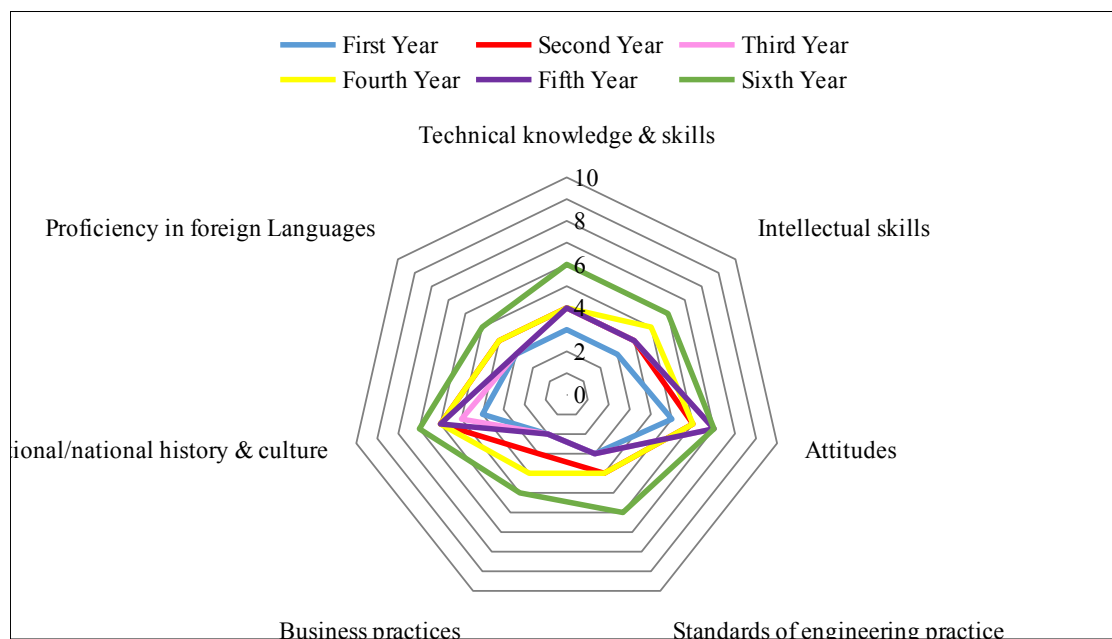


Figure 4.43. Comparison of Confidence levels of First Year to Sixth Year Students

The illustration conveys the confidence level of seven generic skills from First Year to Sixth Year students. First Year is referred by blue radar line and second year is referred by the red. Pink, yellow and violet represent Third, Fourth and Fifth Year respectively. The last green color mentions the Final Year students' confidence level. No other circle in this figure is as immense as the green one. It can be seen that students from Second Year to Sixth Year show the most confidence level at Attitudes. First, Third and Fifth year students are significantly weaker than others in Business Practices.

CHAPTER 5

DISCUSSION, CONCLUSION AND RECOMMENDATION

5.1. Discussion and Conclusion

Technological universities are the major provider of engineering human resources in Myanmar. This study attempts to demonstrate the attributes that are crucial for civil engineering students to become competent human resources in the dynamic and challenging world of civil engineering workplace in the 21st Century.

According to the contractors, attitude is the most crucial attribute of all and the students graded 'Attitude' the highest. Although understanding 'International/National History & Culture' and 'Technical Knowledge and Skills' are also ranked as vital attributes after 'Attitude,' the confidence levels rated by students.

The students can be ranked their confidence level on 'Intellectual Skills' at the same level with understanding 'International/National History & Culture' and 'Technical Knowledge and Skills.'

'Proficiency in Foreign Languages' is the students just show an ordinary confidence level on that matter. Construction industry is a business where communication with the clients, contractors, labors and government is a must. It is important for a civil engineer to understand the business practices of this industry. However, the students can be graded least and under average confidence level when it comes to understanding business practices.

It is obvious 'Attitude' is the only attribute that depends on one's own-self and the rest depend on the external environments. Sometimes, the external environments can influence one's decisions to corrupt. So, it is important to build up one's own-self to attain good attitudes as well as to establish good external environments that can direct one's decisions to the right way.

In this way, Civil Engineering human resources can pass the knowledge from one generation to another and be able to sustain in the long run.

This study gets the available benefits:

1. Endorsing the Civil Engineering students to recognize the required attributes for the engineering workplace and prepare selves in advance,

2. Emphasizing the necessary changes and provisions to be made in advance by Technological University (Myitkyina) to upgrade the current systems and
3. Highlighting the importance of cooperation of students and the industry in producing qualified professional civil engineers.

5.2. Recommendation

This study is not a perfect one as this is the first pilot study that focuses on the development of the civil engineering human resources in Myitkyina Township. This study does not contain the strategies and methods to improve the current systems. Those strategies and methods should be studied in the next studies.

This study is just a demonstration of the current confidence level of Civil Engineering students from Technological University (Myitkyina). Extended research of this kind should be carried out in the upcoming years. Further studies concern with the engineering human resources should be done with respect to other disciplines. In this way, the engineering human resources can develop in the right way.

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APPENDIX A

SURVEY QUESTIONNAIRE

Table A.1. Survey Questionnaire for Students

No	Title	Marks
I. Technical Knowledge and Skills		
1	Science fundamentals	
2	Engineering fundamentals and application	
3	Probability and statistics	
4	Computer science and technology	
5	Engineering practice	
II. Intellectual Skills		
1	Logical thinking	
2	Problem-solving skills	
3	Communication skills	
4	Design skills	
5	Organizational, management and administrative skills	
6	Research Skill	
III. Attitudes		
1	Competence	
2	Integrity	
3	Commitment	
4	Tolerance	
5	Flexibility	
6	Commitment to lifelong learning	
7	Reliability	
8	Conscientiousness	
9	Punctuality	
10	Approachability	
No	Title	Marks

IV. Standards of Engineering Practice		
1	Measurement systems	
2	Technical standards	
3	Specifications and inspection standards	
4	Testing practices	
5	Environmental constraints	
6	Code of ethics	
7	Proficiency standards	
V. Business Practices		
1	Free market economy	
2	International marketplace	
3	Multinational corporations	
4	International competitiveness	
5	Quality assurance	
6	Insurance	
7	Warranties	
8	Bidding procedures	
VI. The International and National History and Culture		
1	Common history	
2	National history	
3	Cultural differences	
4	Economic and political issues	
5	Social life and customs	
6	Gender	
7	Religion	
8	Multiculturalism	
No	Title	Marks
VII. Proficiency in Foreign Languages		
1	Spoken foreign language fluency	

2	Written foreign language fluency	
3	Regional dialects	
4	Technical terminology	
5	Professional jargon	

APPENDIX